A REGULAR MEETING OF THE COUNCIL OF THE TOWN OF LADYSMITH WILL BE HELD IN COUNCIL CHAMBERS AT CITY HALL ON MONDAY, NOVEMBER 20, 2017

Call to Order and Closed Meeting
5:00 p.m.
Regular Open Meeting
7:00 p.m.

A G E N D A

CALL TO ORDER (5:00 P.M.)

1. CLOSED SESSION

In accordance with section 90(1) of the *Community Charter,* this section of the meeting will be held *In Camera* to consider matters related to the following:

- Human Resources Matters 90(1)(c)
- Various matters related to section 90(1)(e) -- the acquisition, disposition or expropriation of land or improvements, if the council considers that disclosure could reasonably be expected to harm the interests of the municipality
- Proposed provision of a municipal service - section 90(1)(k)

REGULAR MEETING (7:00 P.M.)

2. AGENDA APPROVAL

3. RISE AND REPORT – Items from Closed Meeting

4. MINUTES

4.1. Minutes of the Regular Meeting of Council held November 6, 2017 .....1 - 10

5. DELEGATIONS

5.1. Mark Drysdale, Ladysmith Chamber of Commerce Year in Review

6. PROCLAMATIONS

6.1. Adoption Awareness Month 11
Mayor Stone has proclaimed November, 2017 as Adoption Awareness month in the Town of Ladysmith, in recognition of the care, compassion and unselfish commitment of British Columbia adoptive families, and to remind citizens that there are many children and sibling groups in the province who are available for adoption.

6.2. National Child Day..... 12
Mayor Stone has proclaimed November 20, 2017 as National Child Day in the Town of Ladysmith, recognizing the rights of children to be protected and safe from harm, to have access to services, to experience meaningful participation in community life and to have the opportunity to enjoy their childhood.

7. FINANCIAL PLAN DELIBERATIONS

7.1. 2018-2022 Financial Plan Deliberation Dates..... 13 - 19

Staff Recommendation:
That Council authorize the following schedule of meetings to review the 2018 – 2022 Financial Plan:

- Monday, November 20th – set dates for 2018-2022 Financial Plan discussions and introduction to budget process;
- Monday, November 27th – review of preliminary operating budgets;
- Monday, December 4th –review of operating budgets and introduction of the capital budgets;
- Monday, December 11th – third budget workshop and introduction of the 2018 water and sewer rates bylaws;
- Monday, December 18th – adoption of water and sewer rates bylaws and early budget approval of capital projects.

8. REPORTS

8.1. Arbutus Water Treatment Plant, Preliminary Design Refinement Report ..... 20 – 87

Staff Recommendation:
That Council receive for information the Arbutus Water Treatment Plant, Preliminary Design Refinement Report dated November 2017.

*Appendices to the Associated Engineering Preliminary Refinement Report will be printed separately and will be available at City Hall by end of day on Friday, November 17, 2017.

8.2. Community Heritage Register Update .....88 - 101

Staff Recommendation:
That Council:

1. Approve the Statements of Significance for the following 10 heritage properties:
   i. Ladysmith Cemetery, 320 Christie Road
   ii. Nicholson House, 421 1st Avenue
   iii. Old Telephone Office, 422 Esplanade
   iv. 534 1st Avenue
   v. Bayview Apartment Building/Extension Hotel, 110 Esplanade
   vi. Ladysmith Arboretum, Transfer Beach Boulevard
   vii. Knight's Clock, 1st Avenue
   viii. Dragon City Restaurant Sign, 322 Esplanade
   ix. 341 1st Avenue
   x. Ladysmith City Hall, 410 Esplanade
2. Support the inclusion of the 10 properties to the Town's Community Heritage Register.

9. BYLAWS

9.1. Town of Ladysmith Building Fire Sprinkler System Bylaw 2017, No. 1940..... 102 - 109

The purpose of Bylaw 1940 is to maintain the Town's current requirement for fire sprinklers and fire sprinkler systems in buildings in the downtown in certain circumstances beyond the requirements of the BC Building Code.

Staff Recommendation:
That Council give first, second and third reading to Bylaw 1940, cited as "Town of Ladysmith Building Fire Sprinkler System Bylaw 2017, No. 1940".

10. CORRESPONDENCE- None

11. NEW BUSINESS

11.1. Sheila Malcolmson, Member of Parliament for Nanaimo-Ladysmith Abandoned Vessels Bill C-352 – Request for Support of Debate in the House of Commons..... 110 - 111

Bill C-352 is a private member's bill that was introduced in the House of Commons by Sheila Malcolmson, Member of Parliament for Nanaimo-Ladysmith. It amends the *Canada Shipping Act, 2001* to strengthen the

requirements relating to derelict and abandoned boats (wreck) by ensuring that regulations are made to establish measures to be taken for their removal, disposal or destruction. It also designates the Canadian Coast Guard as a receiver of wreck for the purposes of Part 7 of the Act and requires receivers of wreck to take the necessary steps to identify and locate the owner of the wreck. Finally, it provides for the development and implementation of a national strategy to address the abandonment of vessels.

Ms. Malcolmson is requesting that Council insist that Bill C-352 be debated in the House of Commons, as a parliamentary committee recently blocked it from further debate.

Staff Recommendation:
That Council send a letter to Prime Minister Trudeau, insisting that Bill C-352 continue to be debated in the House of Commons despite the introduction of the new Bill C-64, the Wrecked, Abandoned or Hazardous Vessels Act.

12. UNFINISHED BUSINESS

12.1. Alternative Approval Process Official Result -- New Fire/Rescue Apparatus..... 112 - 114

Staff Recommendation:
That Council:
1. Receive the official results of the Alternative Approval Process for borrowing funds to purchase a new Fire/Rescue apparatus;
2. Direct staff to award the contract for the purchase of a new Ladysmith Fire/Rescue Apparatus to Fort Garry Fire Trucks in the amount of $637,581 plus applicable taxes as elector approval of the borrowing has been received; and
3. Direct staff to apply to finance the new Ladysmith Fire/Rescue Apparatus through the Equipment Financing Program of the Municipal Finance Authority.

QUESTION PERIOD

- A maximum of 15 minutes is allotted for questions.
- Persons wishing to address Council during "Question Period" must be Town of Ladysmith residents, non-resident property owners, or operators of a business.
- Individuals must state their name and address for identification purposes.
- Questions put forth must be on topics which are not normally dealt with by Town staff as a matter of routine.
- Questions must be brief and to the point.

- Questions shall be addressed through the Chair and answers given likewise. Debates with or by individual Council members or staff members are not allowed.
- No commitments shall be made by the Chair in replying to a question. Matters which may require action of the Council shall be referred to a future meeting of the Council.

ADJOURNMENT

MINUTES OF A PUBLIC HEARING AND REGULAR MEETING OF COUNCIL
MONDAY, NOVEMBER 6, 2017
CALL TO ORDER 7:00 P.M.
COUNCIL CHAMBERS, CITY HALL

COUNCIL MEMBERS PRESENT:

Mayor Aaron Stone	Councillor Steve Arnett	Councillor Cal Fradin
Councillor Joe Friesenhan	Councillor Carol Henderson	Councillor Rob Hutchins
Councillor Duck Paterson		

STAFF PRESENT:

Guillermo Ferrero	Lisa Brinkman	Erin Anderson
Geoff Goodall	Clayton Postings	Joanna Winter
Sue Bouma		

CALL TO ORDER

Mayor Stone called this Regular Meeting to order at 7:00 p.m., recognizing the traditional territory of the Stz'uminus First Nation, acknowledging 5,500 years of history and stewardship and expressing gratitude to be here.

AGENDA APPROVAL

CS 2017-323

Moved and seconded:
That Council approve the agenda for this Regular Meeting of Council for November 6, 2017 as amended by the following additions and corrections:

- Add to Item 7.3. the proposed resolution from the Interagency Group requesting authorization for an application to the Union of BC Municipalities Age Friendly Grant Program
- Add Item 12.1., "Vancouver Island Economic Alliance Summit Report"
- Add Item 12.2., "Rainbow Crosswalk"
- Add Item 12.3., "Tommy Douglas Display at the Museum"
- Add Item 12.4., "Louis Riel Day, November 16"
- Correct typos to Item 8.2. in the agenda summary and on page 61 of the agenda package.

Motion carried.

PUBLIC HEARING

Mayor Stone welcomed the members of the public and outlined the process for the Public Hearing.

He stated that the Public Hearing would be broken into two parts. The first part of the Public Hearing addressed Bylaws 1937 and 1938 and the second part of the Public Hearing addressed Bylaw1939.

Mayor Stone advised the public that they would have the opportunity to provide their comments about the content of the Bylaws to Council, and that following the close of the Public Hearing, no further submissions or comments from the public or interested persons could be accepted by members of Council.

Public Hearing – Bylaws 1937 and 1938
Members of the public present: *6*

Lisa Brinkman, Senior Planner for Development Services, introduced the agenda item and listed the following five properties as the subject of Bylaw 1937 and Bylaw 1938:
Lot 1, 2, 3, 4 and 5, District Lot 38, Oyster District, Plan VIP84189
1132, 1134, 1138, 1140 and 1142 Rocky Creek Road

She stated that the purpose of Bylaw 1937 was to amend the Official Community Plan to change the designation of the subject properties from "Mixed Use Waterfront" to "Industrial" and to apply Development Permit Area 5 – Industrial to the five subject properties.

Ms. Brinkman stated that the purpose of Bylaw No. 1938 was to amend the Zoning Bylaw to change the zoning from Comprehensive Development 1 – Tourist Service (CD-1) zone to the Light Industrial (I-1) zone, to permit light industrial use on the five subject properties.

The Public Hearing Notice was printed in the Ladysmith Chronicle newspaper on October 25, 2017 and November 1, 2017 and posted on community notice boards through-out Town, as well as on the Town's website. The Notice was mailed and delivered to owners and tenants of 1158, 1156, 1154 and 1152 Rocky Creek Road.

A copy of the Notice, the proposed bylaws and background information considered by Council was made available at the Front Counter of City Hall for the notice period. Staff in the Development Services office was available to respond to questions prior to the public hearing.

There were no written submissions received prior to the Agenda

deadline.

Mayor Stone called for submissions to Council. Mayor Stone called for comments about Bylaws 1937 and 1938 a second and third time. Hearing no comments, Mayor Stone declared the Public Hearing for Bylaws 1937 and 1938 closed and stated that no further submissions or comments from the public or interested persons could be accepted by members of Council.

Public Hearing – Bylaw 1939
Members of the public present: 6

Lisa Brinkman, Senior Planner for Development Services, introduced the agenda item and noted that the Properties that will be 560m^2 or less in size within the Single Dwelling Residential – Holland Creek Area (R-1-HCA) Zone and properties within the Single Dwelling Residential – Small Lot B (R-1-B) Zone were the subject of Bylaw 1939.

Ms. Brinkman stated that the purpose of Bylaw 1939 was to amend the Zoning Bylaw to:

- Change the permitted lot coverage for buildings and structures in the "Single Dwelling Residential – Holland Creek Area (R-1-HCA)" zone from 33% to 35% for parcels that are 560m^2 or less in size; and
- Remove the maximum finished floor area requirement in the R-1-HCA zone and the "Single Dwelling Residential – Small Lot B Zone (R-1-B)" zone.

The Public Hearing Notice was printed in the Ladysmith Chronicle newspaper on October 25, 2017 and November 1, 2017 and posted on community notice boards through-out Town, as well as on the Town's website. Due to the requirements of the Local Government Act, the Notice for Bylaw 1939 was mailed and delivered to all properties located within 60 metres of the property zoned "Single Dwelling Residential – Holland Creek Area (R-1-HCA)".

A copy of the Notice, the proposed Bylaw and background information considered by Council was made available at the Front Counter of City Hall for the Notice period. Staff in the Development Services office was available to respond to questions prior to the public hearing.

Mayor Stone called for submissions to Council.

Jan Christenson, 378 Dogwood Drive, expressed concern regarding

smaller lots in the development's cul de sac, and the possibility of a building scheme that restricts recreational vehicle parking.

Rob Johnson, 526 1st Avenue, enquired about the rationale of the permitted lot coverage percentage increase for buildings and structures in the subject property.

Mayor Stone called for comments about Bylaw 1939 a second and third time. Hearing no further comments, Mayor Stone declared the Public Hearing for Bylaw 1939 closed and stated that no further submissions or comments from the public or interested persons could be accepted by members of Council.

BYLAWS (SUBJECT OF PUBLIC HEARING)

Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw #49, 2017, No. 1937 and Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw #9, 2017, No. 1938
Subject Properties: Lots 1, 2, 3, 4, 5, District Lot 38, 1132 - 1140 Rocky Creek Road

CS 2017-324

Moved and seconded:
That Council receive for information the staff report from the Senior Planner regarding "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw #49, 2017, No. 1937" and "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw # 9, 2017, No. 1938".
Motion carried.

CS 2017-325

Moved and seconded:
That Council proceed with third reading and final reading of Bylaw 1937, cited as "Official Community Plan Bylaw 2003, No. 1488, Amendment Bylaw #49, 2017, No. 1937".
Motion carried.

CS 2017-326

Moved and seconded:
That Council proceed with third reading of Bylaw 1938, cited as "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw #9, 2017, No. 1938"; and refer Bylaw 1938 to the Ministry of Transportation and Infrastructure.
Motion carried.

Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw #10, 2017, No. 1939
Staff responded to Council questions regarding recreational vehicle parking enforcement, zoning bylaws and covenants.

Moved and seconded:

CS 2017-327 That Council receive for information the staff report from the Senior Planner regarding "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw #10, 2017, No. 1939".
Motion carried.

Moved and seconded:

CS 2017-328 That Council proceed with third reading of Bylaw 1939, cited as "Town of Ladysmith Zoning Bylaw 2014, No. 1860, Amendment Bylaw #10, 2017, No. 1939".
Motion carried.

Moved and seconded:

CS 2017-329 That Council refer Bylaw 1939 to the Ministry of Transportation and Infrastructure.
Motion carried.

L. Brinkman left the meeting.

MINUTES

Moved and seconded:

CS 2017-330 That Council approve the minutes for the October 16, 2017 Regular Meeting of Council.
Motion carried.

Moved and seconded:

CS 2017-331 That Council approve the minutes for the October 17, 2017 Special Meeting of Council.
Motion carried.

COMMITTEE REPORTS

Recommendations from the Heritage Revitalization Advisory Commission

Moved and seconded:

CS 2017-332 That Council refer a copy of the draft tree bylaw (2008) to the Heritage Revitalization Advisory Commission for review.
Motion carried.

Council also requested a copy of the draft bylaw.

Moved and seconded:

CS 2017-333 That Council consider enforcement of bylaws for façade improvements in response to concerns expressed by the Heritage Revitalization Advisory Commission regarding unauthorized façade improvements (e.g. paint colour).

Motion carried.

Moved and seconded:

CS 2017-334 That Council refer to the 2018 budget discussions the request by the Heritage Revitalization Advisory Commission to increase the 2018 training, seminar and travel budget for the Heritage Revitalization Advisory Commission by $400.

Motion carried.

Moved and seconded:

CS 2017-335 That Council send a letter to the Ladysmith and District Historical Society requesting that the Society appoint a liaison to the Heritage Revitalization Advisory Commission in accordance with Bylaw 1760.

Motion carried.

Recommendations from the Invasive Species Advisory Committee:

Moved and seconded:

CS 2017-336 That Council refer to staff the recommendations from the Invasive Species Advisory Committee regarding the use of the CVRD invasive species management strategy and public awareness campaign as a basis for the Ladysmith plan, in order to investigate the recommendations and the CVRD strategy, and report back to Council in early January.

Motion carried.

Recommendations from the Interagency Committee

Moved and seconded:

CS 2017-337 That Council authorize an application for up to $25,000 in funding through the Union of BC Municipalities Age Friendly Grant Program to support walkability and accessibility improvements for seniors as proposed by the Ladysmith Resources Centre Association Interagency Committee and Eldercare Project in Cowichan (EPIC) and support the Town administration with overseeing the management of this grant if successful.

Motion carried.

Moved and seconded:

CS 2017-338 That Council receive for information the November 6, 2017 Council member committee reports.

Motion carried.

REPORTS

Fire Hall Bay Expansion – Tender

Staff responded to Council's questions regarding the contingency formula for the fire hall bay expansion project.

Moved and seconded:

CS 2017-339 That Council:

1. Increase the budget for the Fire Hall Bay Expansion project by $74,500 with the funds to come from the Fire Hall Building Reserve and $5,500 from Fire Hall operations; and
2. Award Tender #2017-PRC-06 Fire Hall Expansion to FMI Installations; and
3. Amend the 2017 to 2021 Financial Plan accordingly.

Motion carried.

Opposed: Councillor Fradin

Water Treatment Plant Land Application

Moved and seconded:

CS 2017-340 That Council:

1. Endorse the Crown Land Tenure Application in order to secure additional lands to facilitate construction of the Town's Water Treatment Facility.
2. Appoint Koers Associates to act as the application agent for said application.

Motion carried.

2018 Council Meeting Schedule

Moved and seconded:

CS 2017-341 That Council confirm the following schedule of regular Council meetings and Municipal Services Committee meetings for 2018 and direct staff to advertise the schedule in accordance with Section 127 of the *Community Charter*:

Council Meetings

January 15	April 16	August 20	November 5
February 5	May 7	September 17	November 19
February 19	June 4	October 2 **	December 3
March 5	June 18	October 15	December 17
March 19	July 16		

**Tuesday, to accommodate Tour de Rock in Ladysmith

Municipal Services Committee Meetings

January 8	May 14	July 9	September 10
March 12	June 11	August 13	December 10
April 9			

Motion carried.

Adjustments to Water Billing Account

Moved and seconded:

CS 2017-342 That Council approve adjusting the water billing due to leaks for the following properties:

0479000 for $4,257.01
1377200 for $3,020.58
1421000 for $5,010.01

Motion carried.

Opposed: Councillor Fradin

BYLAWS

Town of Ladysmith Streets and Traffic Bylaw 1998, No. 1309, Amendment Bylaw #5, 2017, No. 1941

Moved and seconded:

CS 2017-343 That Council refer "Town of Ladysmith Streets and Traffic Bylaw 1998, No. 1309, Amendment Bylaw #5, 2017, No. 1941" to the next Municipal Services Committee meeting for discussion.

Motion carried.

CORRESPOND-ENCE

Kathryn Weber
The Dog Park on Davis Road

Moved and seconded:

CS 2017-344 That Council receive the correspondence from Kathryn Weber regarding the dog park on Davis Road

Motion carried.

Moved and seconded:

CS 2017-345 That Council direct staff to consult with the neighbourhood surrounding the Davis Road dog park for recommendations and feedback regarding the park, and to return to Council with a report on these findings early in 2018.

Motion carried.

Citizens for Safe Technology
Microcell Resolution and Notice of Wireless Harm

Moved and seconded:

CS 2017-346 That Council receive for information the correspondence from Citizens for Safe Technology Microcell Resolution and Notice of Wireless Harm.

Motion carried.

Jennifer Merilees
Managing Broker, Ladysmith Branch Royal LePage

Moved and seconded:

CS 2017-347 That Council provide a letter of support for the Ladysmith Branch of Royal LePage to accompany their application to the Defibrillation

Program.
Motion carried.

NEW BUSINESS

Vancouver Island Economic Alliance State of the Island Economic Report
Councillor Arnett provided a summary of the information provided at the Vancouver Island Economic Alliance Summit and suggested that the State of the Island report be used as a resource when planning for economic and business development in Ladysmith.

Rainbow Crosswalk
Councillor Arnett shared the positive responses from the community regarding the rainbow crosswalk and reiterated the need for its upkeep.

Tommy Douglas Display at the Museum
Councillor Arnett invited Council and citizens to visit former Member of Parliament Tommy Douglas' chair at the Ladysmith Museum.

Louis Riel Day, November 16
Councillor Arnett requested that the Town use communication tools such as the website and social media to acknowledge November 16th as Louis Riel Day.

QUESTION PERIOD

Members of the public expressed concerns about the electric charging station being out of order and the dog park noise and hours of use situation. They enquired about the rationale for planning the dog park, when signs regarding hours of use and noise will be erected and whether the public would have an opportunity to present their feelings about the dog park. Members of the public also enquired about the possibility of positioning the water treatment plant at higher elevation, the legislation in relation to the effects and smell of marijuana smoke, and the possibility of changing fines in the Streets and Traffic Bylaw.

ADJOURNMENT

Moved and seconded:
CS 2017-348 That this regular meeting of Council adjourn at 8:32 p.m.
Motion carried.

CERTIFIED CORRECT:

Mayor (A. Stone)

Corporate Officer (J. Winter)

TOWN OF LADYSMITH

PROCLAMATION

ADOPTION AWARENESS MONTH

***WHEREAS**:* *adoptive families in British Columbia provide children with the love and support of a permanent family, and*

***WHEREAS**:* *the Town of Ladysmith wishes to recognize the care, compassion and unselfish commitment of British Columbia adoptive families, and*

***WHEREAS**:* *there continues to be a need for adoptive families to nurture the growth and development of children, especially those with special needs because of physical, mental or emotional disabilities, and*

***WHEREAS**:* *there is a need to remind citizens during this time that there are many children and sibling groups in the province who are available for adoption;*

THEREFORE, *I, Aaron Stone, Mayor of the Town of Ladysmith, do hereby proclaim November 2017 as Adoption Awareness Month in the Town of Ladysmith, British Columbia.*

Mayor A. Stone

November 6, 2017

TOWN OF LADYSMITH

PROCLAMATION

NATIONAL CHILD DAY

***WHEREAS**: Children and youth are our present and future citizens; and*

***WHEREAS**: Canada has designated November 20 as National Child Day to commemorate the adoption of the UN Declaration of the Rights of the Child in 1959; the adoption of the UN Convention on the Rights of the Child in 1991 and a World Fit for Children arising from the UN Special Session on Children in 2002; and*

***WHEREAS**: Canada has pledged the implementation of children's and youth's rights - including rights to protection, rights to be provided services, rights to meaningful participation in society and community life, the right to enjoy their childhood freely and safe from those who would harm them - and furthermore recognizes the important role of the family in bringing up children;*

***THEREFORE,** I, Aaron Stone, Mayor of the Town of Ladysmith, do hereby proclaim November 20th, 2017 as National Child Day in the Town of Ladysmith, British Columbia.*

Mayor A. Stone

November 15th, 2017

STAFF REPORT TO COUNCIL

From: Erin Anderson, Director of Financial Services
Meeting Date: November 20th, 2017
File No:
RE: 2018-2022 FINANCIAL PLAN DELIBERATION DATES

RECOMMENDATION:

That Council authorize the following schedule of meetings to review the 2018 – 2022 Financial Plan:

- Monday, November 20th – set dates for 2018-2022 Financial Plan discussions and introduction to budget process
- Monday, November 27th – review of preliminary operating budgets;
- Monday, December 4th –review of operating budgets and introduction of the capital budgets;
- Monday, December 11th – third budget workshop and introduction of the 2018 water and sewer rates bylaws;
- Monday, December 18th – adoption of water and sewer rates bylaws and early budget approval of capital projects.

PURPOSE:

To establish dates for the discussion of the 2018-2022 Financial Plan.

PREVIOUS COUNCIL DIRECTION:

n/a

INTRODUCTION/BACKGROUND:

Each year a new 5-year financial plan is required to be presented to Council and adopted prior to May 15th. The *Community Charter* provides direction for completing the Financial Plan, which includes the requirement of Council to "undertake a process of public consultation regarding the proposed financial plan before it is adopted".

Council expressed a desire to begin financial plan discussions earlier. These proposed dates achieve this. The tentative schedule for discussions is:

- Monday, November 27th – preliminary operating budgets discussions, including the percentage to allocate to capital projects;
- Monday, December 4th –review the operating budgets, introduction of the capital budget, finalize water and sewer operating budgets and provide direction to draft rate bylaw;

- Monday, December 11th – review capital projects and introduction of 2018 water and sewer rates bylaws;
- Monday, December 18th – adoption of water and sewer rate bylaws and early budget approval of capital projects.

Additional dates may be required. The Financial Plan bylaw must be adopted prior to May 15th, 2018. Tax Rates are set once the budget is finalized and the Assessment Roll is received. It should be noted that the impact on individual property taxation is not known at this time. BC Assessment will provide the completed assessment roll towards the end of March.

The development of the Financial Plan starts and ends with Council. In 2016, Council developed the Strategic Priorities for 2016-2019 and identified Council's top priorities. Department heads submit budgets in support of these priorities. Finance summarizes the numbers and presents the budget to Council for discussion.

Changes for 2018
The 2018 Financial Plan was developed based on the approved 2017-2021 Financial Plan.

Schedule 'A' of Bylaw 1926

2017 – 2021 Financial Plan

	2017	2018	2019	2020	2021
REVENUES:					
Revenue From Property Tax Values	7,733,844	8,043,395	8,279,449	8,499,598	8,730,531
Revenue From Grants In Lieu	159,024	160,773	162,685	165,937	169,255
Revenue From Parcel Taxes	2,254,447	2,563,067	2,847,767	3,132,467	3,132,467
Revenue From Fees & Charges	3,830,817	3,925,800	4,024,372	4,103,512	4,223,327
Revenue From Other Sources	2,486,885	9,252,745	3,892,345	1,683,145	897,345
	16,465,017	23,945,780	19,206,618	17,584,659	17,152,925

There is a $309,551 increase in property tax value revenues between 2017 and 2018. This is equivalent to a 4% tax increase. Much of this increase is due to re-establishing the 10% capital funding levels from the 8% level set in 2017. This change in funding amounts to an increase of $131,214.

The 2018 Financial Plan was also drafted under the assumption that the Water Parcel Tax would increase an additional $75 from $309 to $384 in order to set aside funding for future projects, such as raising the dam, providing the interconnect and other supply improvements. Approximately $475k will be reserved in 2018.

ALTERNATIVES:
There are few alternatives to this process. Council could add or remove dates set for Financial Plan deliberations, though the bylaws still must be adopted prior to May 15th.

FINANCIAL IMPLICATIONS;
Not applicable to setting the dates.

LEGAL IMPLICATIONS;
A Financial Plan must be adopted prior to May 15th.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:
The public is encouraged to provide input into the budget and attend meetings. All meetings are open to the public.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:
Each department is responsible for providing budget information.

ALIGNMENT WITH SUSTAINABILITY VISIONING REPORT:

☐Complete Community Land Use
☐Green Buildings
☐Innovative Infrastructure
☐Healthy Community
☒ Not Applicable
☐ Low Impact Transportation
☐ Multi-Use Landscapes
☐ Local Food Systems
☐ Local, Diverse Economy

ALIGNMENT WITH STRATEGIC PRIORITIES:

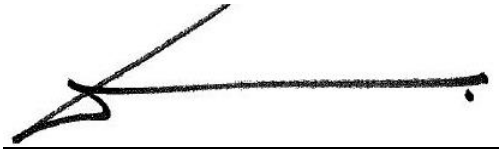
☒Employment & Tax Diversity
☐Watershed Protection & Water Management
☐Communications & Engagement
☐ Natural & Built Infrastructure
☐ Partnerships
☐ Not Applicable

SUMMARY:
Each year, a new five-year Financial Plan is drafted and presented to Council for approval. It is recommended that specific dates are schedule to discuss the 2018-2022 Financial Plan.

November 14, 2017

Erin Anderson, Director of Financial Services

I concur with the recommendation.



Guillermo Ferrero, City Manager

ATTACHMENTS:
Appendix A – 2017-2021 Financial Plan and Policy

Schedule 'A' of Bylaw 1926

2017 – 2021 Financial Plan

	2017	2018	2019	2020	2021
REVENUES:					
Revenue From Property Tax Values	7,733,844	8,043,395	8,279,449	8,499,598	8,730,531
Revenue From Grants In Lieu	159,024	160,773	162,685	165,937	169,255
Revenue From Parcel Taxes	2,254,447	2,563,067	2,847,767	3,132,467	3,132,467
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Revenue From Other Sources	2,486,885	9,252,745	3,892,345	1,683,145	897,345
	16,465,017	23,945,780	19,206,618	17,584,659	17,152,925
EXPENSES:					
General Operating Expense	9,620,547	9,665,221	9,859,177	10,057,025	10,258,812
Sanitary Sewer Operating Expenses	1,473,481	1,147,758	1,174,235	1,201,237	1,228,777
Water Operating Expenses	958,775	1,061,344	1,396,571	1,424,498	1,452,985
Interest Payments	515,408	505,058	705,598	982,390	972,390
Amortization	2,875,406	2,932,915	2,991,573	3,051,406	3,112,434
Annual Surplus/Deficit	1,021,400	8,633,484	3,079,464	868,103	127,527
Add back:					
Amortization	2,875,406	2,932,915	2,991,573	3,051,406	3,112,434
Capital Expenditures					
General Capital	3,834,668	1,503,533	1,594,416	1,285,000	1,044,200
Sanitary Sewer Capital	3,642,987	470,000	335,000	320,000	580,000
Water Capital	7,290,200	9,132,000	6,756,000	7,115,000	400,000
Proceeds from New Debt	(6,635,000)	0	(2,980,000)	(4,985,675)	0
Principal Payments	1,089,927	1,089,099	1,172,272	1,231,772	1,396,772
Transfers from Reserves	(836,500)	(406,933)	(358,839)	(1,216,812)	(238,974)
Transfer to (from) Own Funds	(4,489,476)	(221,300)	(447,812)	170,224	57,963
Financial Plan Balance	-	-	-	-	-

Schedule 'B' of Bylaw No. 1926

Town of Ladysmith 2017 – 2021 Financial Plan
Statement of Objectives and Policies

In accordance with Section 165(3.1) of the Community Charter, the Town of Ladysmith (Town) is required to include in the Five Year Financial Plan, objectives and policies regarding each of the following:

1. The proportion of total revenue that comes from each of the funding sources described in Section 165(7) of the Community Charter;
2. The distribution of property taxes among the property classes, and
3. The use of permissive tax exemptions.

Funding Sources

Table 1 shows the proportion of total revenue proposed to be raised from each funding source in 2017. Council currently has no specific policy surrounding the proportion of total revenue to come from each funding source. Property taxes form the greatest proportion of revenue. As a revenue source, property taxation offers a number of advantages, for example, it is simple to administer and it is fairly easy for residents to understand. It offers a stable and reliable source of revenue for services that are difficult or undesirable to fund on a user-pay basis. These include services such as general administration, fire protection, police services, bylaw enforcement and street lighting.

User fees and charges form a large portion of planned revenue. Many services can be measured and charged on a user-pay basis. Services where fees and charges can be easily administered include water and sewer usage, building permits, business licenses, and sale of services - these are charged on a user-pay basis. User fees attempt to apportion the value of a service to those who use the service.

Objective

- The Town will increase the proportion of revenue that is received from user fees and charges until the fees and charges more closely meet the costs incurred to provide the services.

Policies

- The Town will review all user fee levels to ensure they are adequately meeting both the capital and delivery costs of the service.
- Water and Sanitary Sewer Rates will be reviewed to ensure that appropriate user fees are charged, rather than taxation, to lessen the burden on its limited property tax base.
- Borrowing will be considered when a capital project will provide benefits to taxpayers over a long period.
- Pursuant to Council's direction, the Town will build a reserve to fund major capital projects. For 2017, a minimum of 8% prior year's municipal tax levy will be transferred to General Capital projects as well as setting aside a further 5% for asset replacement. For the years 2018-2021, a 10% prior year's municipal tax levy to General Capital projects.

Table 1: Sources of Revenue

Revenue Source	2017	% total
Property Taxes	7,733,844	26.46%
Grants in Lieu	159,024	0.54%
Parcel Taxes	2,254,447	7.71%
User fees & Charges	3,830,817	13.11%
Other Sources	262,300	0.90%
Borrowing	6,635,000	22.70%
Government Grants	2,224,585	7.61%
DCCs & Reserves	836,500	2.86%
Own Funds	5,288,095	18.09%

Distribution of Property Tax Rates

Table 2 outlines the distribution of property taxes among the property classes. The residential property class provides the largest proportion of property tax revenue. This is appropriate as this class also forms the largest portion of the assessment base and consumes the majority of Town services.

Objectives

- The amount of taxes to be collected from each of the classes will be reviewed each year.

Policies

- Supplement, where possible, revenues from user fees and charges to help to offset the burden on the entire property tax base.
- Continue to maintain and encourage economic development initiatives designed to attract more light industry, retail and commercial businesses to invest in the community. Align the distribution of tax rates among the property classes with the social and economic goals of the community, particularly to encourage economic and environmental sustainability opportunities.
- Regularly review and compare the Town's distributions of tax burden relative to other municipalities in British Columbia.

Table 2: Distribution of 2017 Property Tax Rates

	2017
Property Class	**% of Total Property Taxation**
Residential (1)	72.41%
Utilities (2)	0.38%
Supportive Housing (3)	0.00%
Major Industry (4)	11.95%
Light Industry (5)	0.78%
Business and Other (6)	14.19%
Managed Forest Land (7)	0.00%
Recreation/Non-profit (8)	0.28%
Farmland (9)	0.01%
Total	100%

Permissive Tax Exemptions

The Town provides permissive tax exemptions. The Permissive Tax Exemption Bylaw 2016, No.1915, adopted on October 17, 2016, contains of list of property exempt from taxation for 2016. Some of the eligibility criteria for permissive tax exemptions include the following:

- The tax exemption must demonstrate benefit to the community and residents of the Town by enhancing the quality of life (economically, socially and culturally) within the community.
- The goals, policies and principles of the organization receiving the exemption must not be inconsistent or in conflict with those of the Town.
- The organization receiving the exemption must be a registered non-profit society, as the support of the municipality will not be used for commercial and private gain.
- Permissive tax exemptions will be considered in conjunction with: (a) other assistance being provided by the Town; (b) the potential demands for Town services or infrastructure arising from the property; and (c) the amount of revenue that the Town will lose if the exemption is granted.

Objective

- The Town will continue to provide permissive tax exemptions to some non-profit societies. The Town has also expanded its offering of permissive tax exemptions to include revitalization tax exemptions. It also intends to offer permissive tax exemptions targeted at green development for the purposes of encouraging development that will meet our *Climate Action Charter* commitments.

Policies

- Expand the permissive tax exemption policy to include eligibility requirements for green revitalization tax exemptions.
- Develop a revitalization tax exemption program which details the kinds of green activities that the exemption program will target.

- Integrate the green revitalization tax exemption program into the Town's existing economic initiatives as a means of attracting retail and commercial businesses to further invest in the community.
- Continue the use of the revitalization tax exemption for economic revitalization in order to encourage the commercial and industrial redevelopment of specific areas.

Table 3: Utilization of Reserves, Development Cost Charges and Surplus for 2017

Source	% of Total	Dollar Value
Development Cost Charges - Roads	3%	168,000
Reserve - Amphitheatre	0%	5,000
Gas Tax Funds	11%	663,500
Surplus	86%	5,288,095
Total		$6,124,595

STAFF REPORT TO COUNCIL

From: Director of Infrastructure Services
Meeting Date: November 20, 2017
File No:

RE: Arbutus Water Treatment Plant, Preliminary Design Refinement Report

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RECOMMENDATION(S)

That Council receive for information the Arbutus Water Treatment Plant, Preliminary Design Refinement Report dated November 2017.

PURPOSE

To have Council receive for information the Arbutus Water Treatment Plant, Preliminary Design Refinement Report Dated November 2017.

INTRODUCTION/BACKGROUND

Associated Engineering, the Towns consultant for the new water treatment plant, has now completed the Preliminary Design works for the Arbutus Water Treatment Plant.
There were four main objectives for this report

- Restate the recommendations for treatment upgrades for the Arbutus Water Treatment Plant (WTP) as recommended in previous stages of WTP design.
- Define the design criteria for the individual water treatment unit and related processes.
- Identify the site requirements.
- Confirm the water treatment plant general arrangement and preliminary design specifications at a level of detail sufficient to prepare preliminary design cost estimates.

The basic design criteria follows that of the pilot testing that was completed in 2015 and confirmed that DAF pre-treatment followed by membrane filtration provided effective treatment of the Towns water.

It should be noted that information presented in this report may change as the design of the plant continues to be refined.

The report is broken down into seven sections as follows:

1. Overview
2. Background Information

3. Water Supply and Treatment Plan
4. Water Treatment Process Definitions
5. Water Treatment Plant Siting and Interconnections
6. Preliminary Design Details
7. Cost Estimates

Although all sections of the report are important, staff draws Council attention specifically to section 4, Water Treatment Process Definitions and Section 7, Cost Estimates.

Water Treatment Process Definitions
The current design concept provides a plant capable of delivery treated water to the Town over a 20 year design horizon; this is slightly modified in that initially the Town would only purchase sufficient membranes for 10 years. All infrastructure will exist to receive the new membranes and it will be very easy to add the additional capacity at any time.

Beyond the 20 year horizon the plant has been designed to allow incremental expansion with the addition of DAF units out to the 40 year design horizon. The summary of the design horizon is provided in Table 4-2.

In addition to the design horizon this section provides details about the residuals handling, which essentially the waste from the plant. The current cost estimates are based on these residuals being introduced into the Town sewerage system at Colonia Dr and treated at the WWTP. The Town Sewerage consultant, Opus is currently reviewing the quantity of material expected and the consistency of the material to see if it will pose any challenges for the WWTP. If it is deemed that the WWTP can't treat the material or quantity than on-site treatment options will need to be developed and this will add costs to the project.

Cost Estimates
Table 7-2 capital Cost Estimates provides an updated cost estimate of the project based on information contained in the Preliminary Design Refinement Report. The current estimate is $14,358,000 which includes both a 15% contingency and a 2% project escalation cost.

Table 7-3 Operation and Maintenance also provides an estimate of the ongoing operation and maintenance of the facility which includes staff resources as well as equipment replacement, chemical and electricity. The current estimated annual cost is projected to be $601,000

LEGAL IMPLICATIONS
Staff has not identified any legal issues.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS
N/A

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS
N/A

RESOURCE IMPLICATIONS
N/A

ALIGNMENT WITH SUSTAINABILITY VISIONING REPORT
Innovative Infrastructure

ALIGNMENT WITH STRATEGIC PRIORITIES
This aligns with the 2016 Strategic Priority of Watershed Protection and Water Management.

SUMMARY
The Preliminary Design Refinement Report has now been completed by Associated Engineering. This report provides details of the proposed WTP and updated cost estimates for the facility.

November 15, 2017

Geoff Goodall, Director of Infrastructure Services

I concur with the recommendation.

Guillermo Ferrero, City Manager

ATTACHMENT(S)
Preliminary Design Refinement Report
(Arbutus Water Treatment Plant Phase II)

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

PRELIMINARY DESIGN REFINEMENT REPORT

Town of Ladysmith

Arbutus Water Treatment Plant
Phase II

November 2017

CANADA'S BEST MANAGED COMPANIES Platinum member

Acknowledgements

We would like to acknowledge the input of the following Town of Ladysmith personnel who have been actively involved in the development of the Arbutus WTP upgrades:

- Geoff Goodall
- Kevin Goldfuss
- Curtis Baker

Table of Contents

List of Abbreviations

ADD	Average Day Demand
BCH	BC Hydro
CIP	Clean-in-Place
DAF	Dissolved Air Flotation
DOC	Dissolved Organic Carbon
GCDWQ	Guidelines for Canadian Drinking Water
HMI	Human Machine Interface
HRT	Hydraulic Retention Time
MBT	Membrane Backpulse Tank
MCC	Motor Control Center
MDD	Maximum Day Demand
ML/d	Million Litres per Day
PACl	Polyaluminum Chloride
PLC	Programmable Logic Controller
PPD	Pounds per Day
PRV	Pressure Reducing Valve
TOC	Total Organic Carbon
VFD	Variable Frequency Drive
VIHA	Island Health
WTP	Water Treatment Plant

1 Overview

1.1 REPORT OBJECTIVES

The objectives of this report are as follows:

- Restate the recommendations for treatment upgrades for the Arbutus Water Treatment Plant (WTP) as recommended in previous stages of WTP design.
- Define the design criteria for the individual water treatment unit and related processes.
- Identify the site requirements.
- Confirm the water treatment plant general arrangement and preliminary design specifications at a level of detail sufficient to prepare preliminary design cost estimates.

1.2 PLANT EXPANSION

This report builds from the results of the pilot study and recommended treatment processes as stated in the 2016 “Arbutus Water Treatment Plant Phase II-Filtration – Pre-Design Report”. Phase I of the Arbutus WTP involved building a chlorine disinfection facility. The current phase, Phase II, will involve upgrading the Phase I WTP to add pre-treatment and filtration to the sequence of treatment processes. Phase III (~10 years from now) will expand the treatment capacity of the Phase II infrastructure, and Phase IV (~20 years from now) will expand the WTP structure and further increase the treatment capacity of the WTP.

2 Background Information

2.1 SUMMARY OF PILOT STUDY

Bench scale treatability testing was conducted in 2014 and pilot testing in 2015 to verify the suitability of potential particulate removal treatment processes in treating water from the Chicken Ladder and Stocking Lake intakes. This testing produced the following observations:

- Conventional sedimentation/clarification or dissolved air flotation (DAF) followed by granular media filtration could not consistently meet the treatment objectives for the WTP.
- Coagulation followed by direct membrane filtration could consistently achieve the turbidity and microbiological treatment objectives. However, direct membrane filtration could not adequately remove colour and organics, as well as resulted in a rapid membrane fouling rate.
- DAF pre-treatment followed by membrane filtration enabled all of the Arbutus WTP treatment objectives. DAF also protected the membranes such that the fouling rate was significantly decreased.

To satisfy the Arbutus WTP treatment objectives it was recommended that the existing WTP be upgraded with DAF pre-treatment followed by membrane filtration, using polyaluminum chloride (PACl) as a coagulant. The addition of soda ash was also recommended to improve membrane life, that is, to reduce the membrane fouling rate, and to improve the pH and alkalinity of the treated water.

2.2 DESIGN GOALS

The following design goals are proposed for the Arbutus WTP Phase II:

- Robust design and construction be provided with a focus on reliable, cost effective operation and maintenance.
- The facilities design should consider expansions to the infrastructure in the future to account for continually increasing water demands over time.
- To provide efficient, cost effective operation, while meeting water quality requirements.
- That the facilities be designed, constructed, and made fully operational within the budget and scheduling constraints established by the Town, funding agencies, and regulatory authorities.

The recommended treatment upgrades to the Arbutus WTP are as follows:

- Coarse and fine screening.
- Pre-treatment consisting of coagulation, flocculation, and DAF.
- Membrane filtration.
  Disinfection using the existing chlorine gas system.

These processes are detailed in Sections 4.2 and 4.3.

3 Water Supply and Treatment Plan

3.1 INTAKE CONSIDERATIONS

Arbutus WTP Phase I draws water from the Stocking Lake intake, and the Chicken Ladder intake on Holland Creek. Water from both intakes flows by gravity to a common header inside the Arbutus WTP. Water from Stocking Lake passes through a balancing reservoir and a pressure reducing valve (PRV) station before reaching the WTP.

Water is typically supplied from only one intake at a time, but the Town wishes to retain the ability to run both intakes simultaneously if needed.

In the future, the Town intends to increase their storage capacity at Holland Lake; add a supply main from Holland Lake directly to the Stocking Lake water main, thereby increasing the supply capacity of the Holland Lake – Stocking Lake supply main (HS supply main) without increasing withdrawals from Stocking Lake; and eventually reduce the use of the Chicken Ladder intake during the summer months. Based on discussions with the Town, it was agreed to size the new raw water supply infrastructure for an ultimate, future capacity of 150 L/s from Chicken Ladder and 221 L/s from the HS supply main. The existing supply system currently cannot consistently supply these flow rates. It is assumed that the Town will upgrade their supply system in the future to eventually meet these supply objectives.

In its current configuration, the Town is not able to continuously draw 150 L/s at Chicken Ladder during the summer without risk of drying out Holland Creek. In the summer of 2017 the Town was able to achieve a continuous intake flow of approximately 80 L/s from Chicken Ladder while still contributing water downstream along Holland Creek. The Town may be able to draw greater amounts from Chicken Ladder if they release greater flows from their dam on Holland Lake to Holland Creek, or if Chicken Ladder is used during the winter or spring when there are more runoff contributions to the watershed. Because the headworks inside the WTP will allow water from HS supply main to flow through either set of raw water mains in the plant, whether the Town keeps their maximum withdrawals from Chicken Ladder at 80 L/s or increases them to 150 L/s will not impact the size of process piping and equipment inside the WTP.

3.2 ARBUTUS WATER TREATMENT PLANT

The Arbutus WTP is located close to the Arbutus Reservoir, which is approximately 23 m above the WTP. There is sufficient head pressure in the supply mains that water is treated in the Arbutus WTP in pressurized pipe, and flows via gravity to the Arbutus Reservoir without the need for additional pumping. Water then flows by gravity to the North, Central, and South ends of the Ladysmith distribution system. It is proposed that Phase II of the WTP be built adjacent to Phase I.

3.3 WATER SUPPLY STRATEGY

The proposed water supply strategy is to continue to treat water from either Chicken Ladder and Stocking Lake, alternating between the two sources. The raw water piping entering the WTP will be sized to accommodate the Town's future plan of drawing all water through the HS supply main.

4 Water Treatment Process Definitions

4.1 WATER TREATMENT DESIGN CRITERIA

4.1.1 Design Water Treatment Flow Rates

Water demand projections for design purposes were established in the Technical Memorandum titled "Design Water Demand Projections" (issued January 24, 2017) and are summarized in Table 4-1. Three different demand projects were used in sizing the WTP:

- The Maximum Day Demand (MDD), reflecting the greatest annual greatest water demands that typically occur in the summer, is used to size the process piping and treatment equipment.
- The Average Day Demand (ADD), providing an annual average of projected water demands, is used to estimate operation and maintenance requirements and costs.
- The Winter Maximum Day Demand (Winter MDD): is used as part of sizing the membrane system. While the greatest flow through the WTP will be through the summer, the efficiency of the membranes decreases in colder water temperatures. Therefore, the membranes must be sized to meet the projected summer MDD, when water temperatures are warmer, as well as the Winter MDD, when water temperatures are colder. Based on historical monthly data, the winter MDD typically occurs in December, and is approximately 0.889 times the ADD.

Table 4-1
Water Demand Projections

Year	Population	Winter MDD L/s (ML/d)	ADD L/s (ML/d)	Summer MDD L/s (ML/d)
2018	10,443	45 (3.9)	51 (4.4)	96 (8.2)
2023	11,782	51 (4.4)	57 (4.9)	108 (9.3)
2028	13,509	59 (5.1)	66 (5.7)	125 (10.8)
2033	15,356	67 (5.8)	75 (6.5)	143 (12.4)
2038	16,751	73 (6.3)	82 (7.1)	156 (13.5)
2058	23,932	104 (9.0)	117 (10.1)	221 (19.1)

These design projections do not include any demands from the Saltair community should the Town decide to provide them with treated water. In a teleconference dated May 5, 2017, the Town agreed that the WTP be equipped with enough membrane infrastructure to meet the 10-year design horizon (Phase II), with provisions in the infrastructure to allow for an expansion within the WTP to meet the 20-year design horizon in the future (Phase III). The building was arranged to allow for a logical expansion of the WTP after the 20-year design horizon has been met, as Phase IV of the WTP. Chemical metering pumps have a typical life expectancy of 10 years, thus the metering pumps will be sized for the 10-year design horizon and will be

replaced with larger capacity pumps when they wear out. The buried raw and treated water pipes entering and leaving the WTP will be sized for the 40-year design horizon to allow for expansion of the facility beyond the 20-year horizon. A summary of design horizons for the proposed upgrades to the Arbutus WTP are listed in Table 4-2, and will be detailed in the subsequent sections.

Table 4-2
Summary of Design Horizons

Description	Design Horizon used for Sizing
WTP structure floor space	20-year
Buried piping from Chicken Ladder to WTP	12-year (restricted to 150 L/s)
Buried piping from HS supply main to WTP	40-year
Process piping inside WTP	20-year
Flow meters – installed in 2018	20-year
Flow meters – space for future upsizing	40 -year
DAF pre-treatment	20-year
Buffer tank	20-year
Membrane filtration – installed in 2018	10-year
Membrane filtration – space to add more modules to existing trains	20-year
Membrane filtration – floor space to add additional train [1]	40-year
Chlorination system	20-year
Residuals handling	20-year
Chemical Addition – Dosing Pumps	10-year
Chemical Addition – Chemical Storage Tanks	20-year

Note: 1 – It is proposed to keep all the membranes and their future expansions placed in one location due to the complexity of their piping. Future expansions to the pre-treatment system will be placed adjacent to the WTP building.

Treated water from the WTP will travel directly to the Arbutus Reservoir, where water will gravity flow to the distribution system. Peak Hour Demand will be met by the reservoir and therefore was not a factor for sizing the WTP's treatment capacity.

4.1.2 Intake Design Flow

It is assumed that approximately 5% of flows entering the WTP will be released as waste by the membranes as part of their hydraulic cleaning. The pipelines in the WTP should be sized to account for this 5% loss. In other words, the design flow rate for water entering the plant should be as follows:

- 10-year maximum incoming raw water flow: 132 L/s (11.3 ML/d), with 125 L/s of treated water going to the reservoir and 7 L/s going to residuals handling.
- 20-year maximum incoming raw water flow: 164 L/s (14.1 ML/d), with 156 L/s going to the reservoir and 8 L/s going to residuals handling.

As mention in Section 3.1, it is anticipated that a direct supply main from Holland Lake will be built in the future to tie in to the Stocking Lake supply main, eliminating the need to use the Chicken Ladder intake. It is assumed that the future flow rates supplied from either intake within 20 years of the WTP's upgrade will be expanded from their current capacity up to the following maximum flow rates:

- Chicken Ladder: 150 L/s
- Holland Lake and Stocking Lake (HS supply main): 164 L/s.

Beyond the 20-yr horizon, the Town will rely primarily on HS supply main for all of their raw water, to a maximum capacity of 221 L/s

The existing buried mains from the two intakes to the WTP site are sufficiently sized to deliver water at an adequate pressure up to the maximum anticipated flow rate from the intakes, that is, up to 150 L/s from Chicken Ladder and 221 L/s from Holland Lake / Stocking Lake (via the HS supply main). Several segments of pipe the existing HS supply main are small in diameter and will result in a large amount of headloss as flow rates through the main increase. If the Town decides to upsize these pipe segments in the future, water entering the WTP from Holland Lake / Stocking Lake will have a greater water pressure, which will present opportunities to recover some of this excess pressure as energy to power parts of the plant. The hydraulic profiles of the supply mains are provided in Appendix A and hydraulic modelling results are discussed in Section 5.2.

4.1.3 Water Quality

Table 4-3 summarizes the water quality data collected from the Town's two water sources, as presented in the Town's 2015 Annual Water Quality Report.

Table 4-3
Raw Water Quality Summary

Parameter	Chicken Ladder			Stocking Lake		
	Minimum	Average	Maximum	Minimum	Average	Maximum
Turbidity (NTU)	0.2	0.6	20.0	0.1	0.3	1.0
pH	6.4	6.9	7.1	6.8	7.2	7.5
True Colour (TCU)	7.0	19.5	44.7	6.0	14.3	27.9
TOC (mg/L)	0.7	2.9	4.5	1.2	2.7	4.6
DOC (mg/L)	1.5	2.4	3.5	2.0	2.5	3.2
UVT (%)	60.5	80.2	88.2	77.3	82.5	85.7
Total Hardness (mg/L as $CaCO_3$)	6	7	12	6	7	12
Alkalinity (mg/L as $CaCO_3$)	3	5	7	3	9	12
Total Aluminum (mg/L)	0.028	0.042	0.053	0.030	0.036	0.041
Total Iron (mg/L)	0.028	0.060	0.096	0.053	0.072	0.091
Total Manganese (mg/L)	0.001	0.002	0.003	0.003	0.004	0.005

Note: Highest turbidity manually measured was 12 NTU. A spike of 20 NTU was measured from an online turbidimeter.

The level of disinfection byproducts measured in the distribution system in 2015, and the disinfection byproduct formation potential, measured directly from the two water sources in 2015, are summarized in Table 4-4.

Table 4-4
Disinfection Byproduct Summary

Parameter	Distribution System Measured Levels (mg/L)			GCDWQ limit (mg/L)[1]	Formation Potential	
	Minimum	Average	Maximum		Chicken Ladder	Stocking Lake
Total THMs	0.062	0.079	0.100	0.100	0.220	0.270
Total HAAs	0.070	0.085	0.100	0.080	0.166	0.175

Note: 1 – GCDWQ operational objectives do not apply to formation potential, only to levels observed in distribution system.

Data is not available on the presence of algae in the source waters. However, with the anticipation of longer, dryer, and warmer summers in the future there is a risk that algae growth in the supply lakes will occur.

4.1.4 Water Treatment Objectives

The finished water quality from the Arbutus WTP is to meet or exceed the Guidelines for Canadian Drinking Water Quality (GCDWQ) and comply with any further requirements set by Island Health (VIHA). The key treatment objectives are as follows:

- Turbidity < 0.1 NTU in 99% of the measurements taken, and < 0.3 NTU at all times.
- Minimum 4-log removal or inactivation of viruses.
- Minimum 3-log removal or inactivation of *Cryptosporidium parvum* and *Giardia lamblia*.
- Removal of true colour to below the aesthetic objective of < 15 TCU.
- Reduction of DBPs to less than the GCDWQ operational objectives.
- Limit the increase in total aluminum concentrations due to treatment to < 0.100 mg/L from incoming raw water concentrations.
- Maintain a minimum 0.2 mg/L free chlorine residual throughout the distribution system.

The GCDWQ Guideline Technical Document for Enteric Protozoa: *Giardia* and *Cryptosporidium* states that for membrane filtration the cyst/oocyst removal efficiency must be demonstrated through challenge testing and verified by direct integrity testing. The membrane modules used during piloting were validated for 3-log removal of *Giardia* and *Cryptosporidium*; it must be ensured that the membranes selected for full-scale implementation are likewise validated.

The GCDWQ Guideline Technical Document for Enteric Viruses states that award of virus removal credits for ultrafiltration membranes, or microfiltration membranes preceded by a coagulant, also requires a demonstration and challenge testing, as well as verification by direct integrity testing. However, the intent is to rely on chlorination to achieve the 4-log level of virus removal/inactivation, thus testing to verify the level of virus removal achieved by the membranes is not needed.

4.2 WATER TREATMENT PROCESS

It is proposed that the upgraded WTP use the following processes:

- *Screening:* Coarse screening to remove raw water debris and larger particles that could damage the membrane filters, then fine screening to protect the membranes from finer debris.
- *Pressure Reduction and Flow Control:* To regulate flow from the Stocking Lake and Chicken Ladder intakes, and to prevent overflow of open-to-atmosphere pre-treatment tanks.
- *Chemical Coagulation and Mixing:* Application of soda ash and polyaluminum chloride (PACl) for pH adjustment, alkalinity stabilization, and to improve particle and organics removal.
- *Flocculation:* Application of mixing energy for an appropriate length of time when coagulant is in use to produce a floc optimized for membrane removal and to provide contact time.

- *Dissolved Air Flotation:* The flotation of low-density particles for the removal of colour, organics, DBP precursors, and algae.
- *Buffer Tank:* Transitional storage between the constant flow of the DAF system and the varying flux of the membrane system.
- *Membrane filtration:* To remove turbidity, particulates, bacteria and protozoa.
- *Chlorine Disinfection:* To inactivate viruses and bacteria, and to maintain a residual in the distribution system.
- *Residuals Handling:* Utilization of a lamella plate settler to separate solids from the liquid fraction of the waste produced during treatment. The majority of the recovered liquid will be recycled to the head of the plant.

A process flow diagram and process and instrumentation diagrams for the WTP are provided in Appendix A.

4.3 WATER TREATMENT PROCESS LOADING CRITERIA

The following tables identify the basic design criteria for each of the unit processes.

4.3.1 Screening

Raw water from Stocking Lake will enter the WTP and pass through a coarse screen (manually cleaned) followed by a fine screen (self-cleaning). Raw water from Chicken Ladder will enter the WTP in a parallel line that is also equipped with a coarse screen and a fine screen. The two lines will have a normally closed line connecting the two, that will allow water from one intake to be rerouted to the other line. Thus, if one line or set of screens is offline for maintenance or repairs, water can still be routed from either intake through the screening process to the next stage of treatment. The design assumes that water will be routed through either one pair of coarse and fine screens, or the other.

While the maximum capacity from Chicken Ladder will be less than Stocking Lake, both lines inside the WTP will be sized to accommodate the flow rates from Stocking Lake, so that water can be routed through either set of screens with minimal changes to WTP hydraulics.

Pressure gauges or transmitters will be installed upstream and downstream of the screens to monitor headloss through each screen. When headloss reaches a pre-set threshold, the screens will require cleaning, either manually or by using a self-cleaning configuration. As the incoming water to the plant is generally of good quality, it is anticipated that the fine screens will require cleaning far more frequently than the coarse screens. It is therefore proposed that the fine screens be equipped with automatic, self-cleaning equipment.

Table 4-5
Screening Design Criteria

Coarse Screens	
Number of Units	Two total, one on each intake line
Unit Capacity	164 L/s each
Screening Size	6 mm
Cleaning Type	Manual cleaning
Fine Screens	
Number of Units	Two total, one on each intake line
Unit Capacity	164 L/s each
Screening Size	500 um
Cleaning Type	Self-Cleaning

4.3.2 Flow Control

Flow and pressure from the intakes will be controlled by a flow control valve located on each intake line inside the WTP. The flow control valves will adjust the degree that they are open to achieve one of three default flow rates to achieve the approximate desired flow rate as read on the flow meter downstream. The flow through the control valves will be based on water levels in the reservoir, with the valve opening further if reservoir water levels deplete. These flow setpoints, detailed in the control philosophy, will be adjustable by the operators.

The Town's water demands will decrease during the winter. Similarly, the treatment capacity of the membranes will decrease during the winter because colder water temperatures decrease the amount of water that can pass through a membrane fibre. It is therefore proposed that the flow control valves have a "Summer Mode" and "Winter Mode", and that the flow control valves have different flow setpoints depending on which mode is active.

As part of controlling flow, the control valves will significantly reduce pressure in the line from 46-85 psi, to near atmospheric to avoid flooding of the open pre-treatment and DAF tanks downstream. Anti-cavitation trim is required inside the flow control valves to avoid damage to the valves.

4.3.3 Chemical Pre-treatment

Soda Ash

Soda ash addition is proposed to increase the pH and alkalinity of the water. This will reduce the rate of membrane fouling and will reduce the corrosiveness of the treated water. A minimum alkalinity of 15 mg/L as $CaCO_3$ was requested by the membrane vendors in order to protect the membranes. During piloting a

60 mg/L dose of soda ash produced a final alkalinity of 35 mg/L as $CaCO_3$. An alternate dose was not tested during piloting. In-house modelling using WaterPro and the Rothberg, Tamburini and Winsor models indicated that roughly half the soda ash dose was predicted to produce an alkalinity of 30 mg/L as CaCO3, however these models tend to overestimate changes to alkalinity when the initial alkalinity is very low. Therefore, the design of the soda ash system is based on an anticipated dose of 60 mg/L. This dosage could be gradually lowered after commissioning to achieve a lower soda ash dose that maintains the alkalinity objective of 15 mg/L as $CaCO_3$.

The soda ash system will consist of a hopper into which dry soda ash is stored. A screw conveyer will feed the soda ash to a 1500 L slurry tank to create a 60 g/L (6% wt) solution. It is proposed that the soda ash solution be dilute, to ensure that the soda ash in the slurry remains dissolved even when the temperature of the water feeding the slurry tank is cold.

Soda ash will be delivered to site in 1000 kg tote bags, and individually loaded onto the hopper. The hopper can hold approximately three of the 1000 kg bags. The chemical room will have sufficient room to store an additional 7 bags of soda ash so that, in 20-years time, new chemical does not need to be shipped to site more frequently than once every 8 to 12 days during the summer. During the first ten years of operation it is anticipated that 7 bags of soda ash will last over 20 days on average. The bags will sit on shipping pallets and be wheeled into position for lifting onto the soda ash unloader using a monorail and frame supplied with the soda ash unloader.

The soda ash slurry will be pumped to its point of injection using one of two pumps. The second pump will act as a standby in case the duty pump fails. The two pumps will alternate as the duty pump each time the reservoir calls for more water.

Table 4-6
Soda Ash Design Criteria

Soda Ash Addition	
Dose range	30 – 60 mg/L
Typical dosage	60 mg/L
Stored form	Dry solid
Stored quantity	Hopper make-down system. Hopper to have sufficient storage to operate 3 days at 20-year MDD and maximum dose without replenishment. 3 m^3 storage in hopper.
Solution details	Dissolve to 60 g/L solution

Pumping details	Metering pumps sized for 10-yr MDD and maximum dose. 680 kg/day or 475 L/hr

PACL

Pilot testing indicated that PACl was the most effective at enhancing the pre-treatment steps and remove colour and organics. No polymer is needed for the DAF process. During piloting the optimum PACl dose was 15 mg/L. It is proposed that PACl be stored in a tank sufficient to hold at least 25 days of chemical when consumed at the "typical" dose and at the average flow rates projected in 20 years.

It is proposed that PACl be delivered to site in 1,000 L totes and pumped from the totes to the storage tank using a portable chemical transfer pump. The empty totes can then immediately be sent off site.

PACl will be pumped from the storage tank to its point of injection using a pair of metering pumps. Only one pump will run at any time, the other acting as standby. The two pumps will alternate as the duty pump each time that the reservoir calls for water. The metering pumps have an anticipated life of ten years. After they have passed their life expectancy, they can be replaced with larger metering pumps appropriate for the next ten years of plant operation.

Table 4-7
PACl Design Criteria

Polyaluminum Chloride (PACl)	
Dose range:	1-20 mg/L
Typical dosage	15 mg/L
Stored for	Liquid PACl (ClearTech), 25-40% solution
Stored quantity	Sufficient volume for 25 days at 20-yr ADD and average dose. 2,700 kg PACl or 8600 L. of solution
Solution details	At 25% w/w, 313 g/L of PACl
Pumping details	Metering pumps sized for 10-yr MDD and maximum dose. 216 kg/day or 29 L/hr

4.3.4 Pre-Treatment System

The coagulation (rapid mix), flocculation (slow mix), and dissolved air flotation (DAF) treatment equipment will be supplied by a single vendor. The WTP layout is based on a Leopold design, using concrete tanks that will be formed by the general contractor. Alternative pre-treatment packages from Suez and AWC will be considered during tender. While Leopold and Suez have indicated that their systems will be more cost effective using concrete tanks, AWC has indicated that their system is more cost effective using aluminum tanks. Therefore, the detailed design will assume that concrete tanks will be used, but if an AWC

alternative model is proposed by the general contractor and it meets the performance and access (above and around the tanks) requirements, the tanks may instead be stainless steel construction. The language of the construction contract will allow for either concrete or stainless steel option to be used.

Water that has been dosed with soda ash and PACl will enter into the single coagulation tank where the water will undergo rapid mechanical mixing before continuing to the flocculation tanks.

Table 4-8
Coagulation Design Criteria

Coagulation	
Mixing type	Vertical mixer in an open concrete tank
Number of units	One tank sized for 164 L/s
Hydraulic retention time (HRT)	15-30 seconds

Water from the coagulation tank will flow to two parallel trains for flocculation and DAF. The combined capacity of the two trains will be for the 20-year design flow MDD. Because of the relative cost and footprint of adding a redundant train, and the relatively low risk and consequences of a train failing, it is proposed that a third, redundant train not be included at this stage. A third train will be added when the Town's water demands exceed its 20-year projections. Future DAF trains will be built adjacent to the Phase II WTP structure. Isolated buried mains will be installed as part of Phase II of the WTP to allow for future DAF trains to connect and draw raw water from the Phase II headworks, and to deliver DAF-treated water back into the WTP to the buffer tank.

Each train will consist of two flocculation tanks in series followed by the DAF tank. The mechanical mixers in the floc tanks will operate at slow speeds to encourage the formation of fine floc. Two DAF tanks are proposed, and recommended by DAF manufacturers, to ensure sufficient contact time has passed during flocculation to form the desired floc.

During the DAF process, the air-saturated water will be injected into the tank to form micro-bubbles that will lift the floc particles to the surface of the tank. This float sludge will skim off the top of the tank using mechanical skimmers. To generate the air-saturated water, the DAF tank will be equipped with a duty and standby recycle pump to move water back to the head of the DAF tank, a duty and standby air compressor to provide the pressurized air, and a saturator that combines the recycle water with the compressed air. The DAF tank will use an overflow weir to maintain a constant water level in the tank. While more aggressive loading rates were considered for DAF, pilot testing only confirmed successful operation at a loading rate of 12 m/h. Without the time available to confirm more aggressive rates, it is recommended that the DAF system be sized using the verified 12 m/H loading rate. Over time, the Town can test to see whether a more aggressive loading rate can be successfully used, which if successful would delay the need to add additional DAF tankage in the future.

Table 4-9
Flocculation Design Criteria

Flocculation	
Number of trains	Two duty trains, sized for 164 L/s total.
Number of tanks	Two floc tanks per train.
Hydraulic retention time (HRT)	7.5 minutes per individual tank 15 minutes total per train (two tanks each)

Table 4-10
DAF Design Criteria

DAF	
Number of tanks	Two trains, on DAF tank per train Combined capacity of trains is 164 L/s.
Design loading rate	12 m/h
HRT per tank	7-9 minutes
Recycle percentage at max flow	15%

Each DAF tank can operate most efficiently between 50-100% of its maximum design capacity, where a reduction in treatment flows results in a reduction in the rate that saturated water is recycled through the tank. This allows the DAF system to adjust its rate of operation depending on the flow of water coming in from Chicken Ladder or Stocking Lake.

It is proposed that the DAF system have a “Summer Mode” and a “Winter Mode” like the flow control valves. When in “Winter Mode”, only one DAF train would be active instead of two. Running only one train during the winter will allow the DAF system to operate more efficiently within its 50-100% optimum capacity range to match the reduced water demands that the Town has during the winter.

Water levels in the DAF tanks will be maintained using an overflow weir, at an approximate height of 3.7 m.

4.3.5 Buffer Tank

While the DAF system will run at a generally constant flow, flow through the membranes will vary as trains will need to be individually brought off-line as part of regular hydraulic cleanings (backpulses), chemical maintenance washes (MW), chemical clean-in-place (CIP) operations, and membrane integrity tests (MIT). A buffer tank is proposed to equalize flows between DAF and membrane filtration. The buffer tank is sized to allow the WTP to run at the full 20-year MDD capacity (assuming additional membrane modules are added in the future) even with one membrane train offline and for some scenarios where two of the trains are offline for a period of time.

In the unlikely event that one membrane train is offline for more than a day due to repairs being needed, and the operators want to bring a second train offline for a chemical cleaning, the buffer tank is sized to allow the WTP to continue running at a reduced capacity. However, if one train is offline for repairs and a second train is pulled offline for an MIT, the buffer tank sizing will allow the plant to continue operating at full capacity. The reasoning for this approach is that the operators will generally be able to defer chemical cleans to a time when demands are lower, thereby allowing a temporary reduction in plant capacity while a cleaning occurs. In contrast, daily MIT's are required as part of guaranteeing protozoan removal and typically cannot be deferred.

Another consideration that was taken into account when sizing the buffer tank was that the membranes cannot process water as quickly during the winter than in the summer, the cold temperature of the water reduces the efficiency of the membranes.

A summary of the different scenarios that were accounted for when sizing the buffer tank are provided below. A more detailed list of the different scenarios considered is provided in Appendix C.

Table 4-11
Buffer Tank Design Criteria

Scenarios	20-Year Design Conditions		10-Year Design Conditions	
	Max Incoming Flow from DAF (L/s)	Buffer Tank Volume Needed (m^3)	Max Incoming Flow from DAF (L/s)	Buffer Tank Volume Needed (m^3)
Summer Conditions				
Design MDD	164 (upstream of membranes)		131 (upstream of membranes)	
Normal Operation				
One Train Offline for CIP	164	118	131	112
One Train Offline Long Term for Repairs				
Second Train Offline for MIT	164	119	131	95
Second Train Offline for MW	82 [1]	2	82 [1]	31
Second Train Offline for CIP	82 [1]	79	67 [1]	103
Winter Conditions				
Design MDD	77 (upstream of membranes)		62 (upstream of membranes)	
Normal Operation				
One Train Offline for CIP	77	0 [2]	62	14
One Train Offline Long Term for Repairs				

Second Train Offline for MIT	77	54	62	45
Second Train Offline for MW	77	61	62 [1]	49
Second Train Offline for CIP	43 [1]	105	35 [1]	101

Notes:

1 – When only one train is running and the second is undergoing a chemical clean, the DAF system will reduce speed for the duration of the cleaning.

2 – By the time that the train is done the CIP and is ready to come online, the other two trains will have treated any excess water stored in the buffer tank. During the CIP process, a second train will periodically undergo a backpulse, requiring approximately 5 m^3 of storage in the buffer tank.

Based on these criteria the buffer tank will have a minimum storage capacity of 120 m^3. The buffer tank will be concrete. The maximum water level in the buffer tank will be 3.5 m, to not exceed the water level maintained in the DAF tanks. During start-up of the membrane system, fine tuning of the chemical cleaning processes will be conducted to ensure that the buffer tank will not overflow while one or two trains are offline.

4.3.6 Membranes

Water will gravity flow from the buffer tanks to a set of permeate pumps that will push water through a set of pressurized membranes. The membrane system will consist of three trains, each sized to provide 50% of the design capacity, that is, two duty trains and one standby train. When installed the trains will be sized for the 10-year MDD but can be upgraded to the 20-year MDD by simply adding more modules to the empty racks on the three existing trains. Space for a fourth train will be reserved to expand the membrane capacity to the 40-year MDD.

Table 4-12
Membrane Design Criteria

Design Element	Design Criteria
Type	Pressurized membrane
Number of trains	Three Two duty + one standby
Summer (minimum) [1]	10°C producing 125 L/s net treated water
Winter (minimum)	4°C producing 59 L/s net treated water
Design minimum membrane recovery	95% [2]
Incoming design pressure (pre-permeate pump)	Atmosphere – 3 m (Atm.-4 psi)
Module Surface Area	55.7 m^2

Design Element	Design Criteria
Number of Modules	60 per train (for 10-year design) 76 per train (for 20-year design) 80 per train (spare slots)
Maximum Flux	80.6 lmh (summer water temperatures) 34.7 lmg (winter water temperatures)

Note:
1 - Summer water temperatures have exceeded 10°C, but 10°C has been selected as the minimum temperature that would be experienced in the summer.
2- The recommended membrane vendor has indicated that they can achieve 97% recovery during periods of low turbidity.

As noted in Table 4-12, the membrane treatment capacity decreases when water temperatures are low. Having a “Summer Mode” and “Winter (reduced flow) Mode” for the flow control valves and DAF system upstream will allow the WTP to meet the Town’s summer and winter demands without overflowing the membranes during a particularly cold winter.

A procurement process was used to select the membrane vendor for this project. Requests for proposals were sent to the following vendors, based on their experience across North America in similarly sized water treatment plants:

- GE
- Pall
- Evoqua

GE was recommended for the Arbutus WTP.

Water is driven by permeate pumps through pressurized membrane system (outside-to-in). The permeate is then additionally pressurized using in-line booster pumps to provide sufficient pressure to drive the water through the rest of the WTP and up to the reservoir.

As part of its operation the membrane system will require hydraulic cleanings (backwashes or backpulses), chemical clean-in-place (CIP), and a more frequent but less intensive chemical maintenance wash. For the cleanings, the membrane will draw from a connection to the treated water main that leaves the Arbutus Reservoir and passes beside the WTP. GE has confirmed that the gravity pressure available from the reservoir (40 – 50 psi) will be sufficient for the hydraulic cleanings. Pneumatically actuated valves will be used to control the frequency, duration and intensity of the hydraulic cleanings.

Treated water will be used to flush water out of the membranes at the end of a chemical cleaning. The GE system will rely on three cleaning chemicals (citric acid, hydrochloric acid, and sodium hypochlorite) and two chemical neutralizing agents (sodium bisulphite and sodium hydroxide) and one CIP/neutralization

tank. When a chemical cleaning is activated, the CIP tank will be filled with the one cleaning chemical, and treated water added to the tank as needed. This chemical solution is circulated and flushed out of the membranes back to the CIP tank. The membrane is brought online while the chemical solution is then circulated through a closed loop where the neutralizing chemical is added. This neutralized solution is then emptied from the tank down to the wastewater tank (see Section 4.4 regarding residuals management). The CIP tank is then filled with the next cleaning chemical. When this next solution is prepared the membrane train is brought back offline and the second chemical is circulated through the system, then neutralized in the same manner as the first cleaning. In other words, when a membrane requires cleaning, it will undergo cleaning from a single chemical, then be brought back on-line until the next chemical is ready, then brought back offline for the second cleaning.

The table below summarizes the anticipated membrane cleaning schedule. The membrane logic will be configured such that a maintenance wash cannot be triggered while another membrane is simultaneously offline for a CIP. This will minimize the number of trains that are offline during their operation.

Table 4-13
Membrane Cleaning Details

Cleaning Protocol	Description	Duration
Hydraulic Cleaning	Once every 26 minutes (water temperature 10°C) Once every 62 minutes (water temperature 4°C)	162 seconds
Maintenance Wash	6 times /week/train using 250 mg/L sodium hypochlorite 1 time/week/train using 500 mg/L citric acid and hydrochloric acid	30 minutes
CIP	12 times/ year/ train using 500 mg/L sodium hypochlorite, followed by 2000 mg/L citric acid and hydrochloric acid	6 hours

In addition, each train shall undergo a daily Membrane Integrity Test (MIT) as part of validation that the membranes are operating properly. The MIT will determine whether there are any leaks or breaks inside the train that will require repair. Each MIT is anticipated to take up to 15 minutes to complete.

4.3.7 Disinfection (Chlorination)

Chlorine disinfection is required to ensure that 4-log removal/inactivation of viruses is achieved and to produce a chlorine residual for secondary disinfection. The Town currently has a chlorine gas system in place at the Arbutus WTP. Chlorine is added to a buried main west of the treatment plant just before it reaches the reservoir. The reservoir provides contact time for the chlorinated water prior to supplying the distribution system via gravity.

The Town is interested in replacing the chlorine gas system with an onsite sodium hypochlorite generation system. In the interests of controlling the capital costs for building Phase II of the WTP, it is intended that the Town keep the existing chlorine gas system at this time. However, we have confirmed that there is sufficient space in the existing chlorination and pump room of the existing WTP for on-site generation at a later date. The design criteria for the existing chlorination system is as follows:

Table 4-14
Chlorine Gas Design Criteria

Primary & Secondary Disinfection	
Design dosage	1-4 mg/L
Typical dose (assumed)	2 mg/L
Average day chlorine consumption 10-year ADD 20-year ADD	 11 kg/day (25 PPD) at 2 mg/L and 66 L/s 14 kg/day (31 PPD) at 2 mg/L and 82 L/s
Maximum day chlorine consumption 10-year MDD 20-year MDD	 43 kg/day (95 PPD) at 4 mg/L and 125 L/s 54 kg/day (119 PPD) at 4 mg/L and 156 L/s
Chlorine container storage	4 x 150 lb cylinders
Total container storage (full + empty)	8 cylinders
Online containers	1 or 2
Container weight scales	2 individual scales
Peak instantaneous chlorine consumption	54 kg/day
Chlorinator capacity	200 ppd (90.9 kg/day) – 1 duty + 1 standby
Vacuum regulator capacity	200 ppd (90.9 kg/day)
Scrubber	None

It is proposed to move the point of chlorine injection from outside the WTP to inside the building, above ground. This will eliminate the confined space where the injection point is currently located, and the risks associated with confined spaces.

It is proposed that Phase II of the WTP use the same emergency procedure as is currently in place should a chlorine leak occur in the existing WTP chlorination rooms. Specifically, an alarm would sound on site, the louvres would close and the ventilation system would shut down to contain the gas leak inside the chlorination room. When ready, the operators will be able to manually vent the chlorine room using a manual override button located outside the WTP.

4.4 RESIDUALS AND OVERFLOW MANAGEMENT PROCESS LOADING CRITERIA

The proposed residuals and overflow management design is shown as a process flow diagram in Drawing D-004, and is detailed in the following subsections. A summary of the anticipated residuals is summarized in Table 4-15.

Table 4-15
Summary of Anticipated Residuals

Source	Description	Sent To:
Fine Screens	Self-cleaning waste: raw water	MBT
DAF	Float sludge : concentrated particulates and PACL	Wastewater Tank
DAF	Tank drains : untreated water	Overflow Pond
Buffer Tank	Tank drains : untreated water	Overflow Pond
Membranes	Hydraulic cleaning waste/backpulses : concentrated particulates and unchlorinated water	MBT
Membranes	CIP and MW waste : neutralized chemical waste	Wastewater Tank
Floor Drains	Various floor drain wastes	Wastewater Tank
Washrooms. Locker and Sinks	Domestic waste	Wastewater Tank
MBT	Unchlorinated water	Thickener
Thickener	Supernatant	Head of WTP
Thickener	Settled sludge	Wastewater Tank
Wastewater Tank	Various wastes	Sewer System

4.4.1 Membrane Backpulse Tank

The membrane backpulse tank (MBT) will receive water released from the membranes as part of the hydraulic cleanings. Approximately 5% of the total influent flow of water to the membranes will be released as hydraulic cleaning waste.

The fine screens will periodically require cleaning. The self-cleaning process requires 6.25 – 12.5 L/s for 60 seconds. This self-cleaning water will be directed to the MBT.

We propose that MBT be sized to hold 4.8 hours of WTP-generated waste. When sizing the MBT, it was assumed that the membrane hydraulic cleaning (backpulse) waste would be sent to the MBT on a near-

continuous basis, while draining one of the DAF tanks would be a short-term load. In other words, the MBT was sized to hold the amount of membrane backpulse waste anticipated to be generated over a 4.8 hour period (at the 20-year MDD), and one fine screen going through a self-cleaning process.

Table 4-16
MBT Design Criteria

Membrane Backpulse Tank	
Wastes received	Membrane backpulse (hydraulic cleaning) waste Fine screen strainer self-cleaning wash waste
Maximum incoming waste flow (membranes) [1] 10-year MDD 20-year MDD	 6 L/s (542 m^3 /day) 8 L/s (669 m^3 /day)
Incoming waste flow (self-cleaning fine screen)	60 seconds at up to 12.5 L/s (750 L). Short term waste load.
Tank storage elements	4.8 hours of membrane waste at 8 L/s (134 m^3) Full fine screen self-cleaning (0.75 m^3)
Tank storage capacity	135 m^3
Tank dimensions	7.6 m diameter x 3.6 m tall Includes 0.6 m freeboard
Tank location	Above ground
Tank inlet details	Gravity feed
Tank outlet details	Pump to gravity thickeners and plate settlers

Notes: 1 – Backpulse waste flow volume estimates provided by GE, assuming 95% recovery and occurring during the summer's peak day demand.

4.4.2 Residuals Coagulant System

It is proposed that water sent to the MBT will be treated using coagulation followed by settling be used to remove the majority of solids from the waste stream. The supernantant will be sent to the head of the plant, while the settled sludge will be sent to the wastewater tank for offsite disposal.

Coagulant will be added to water pumped from the MBT to the waste settling system. Polymer is typically used for this application, but over concern that residual polymer could remain in the recycled residual water and make its way to the membranes, PACl has been proposed for this application. Ecodyne has confirmed that PACl should be suitable for their plate settler and gravity thickener.

Table 4-17
Residuals Management Coagulation Design Criteria

Coagulant System	
Design dosage range	0.1 – 10 mg/L as straight chemical
Design flow rate (6% of total WTP flows): At 10-year MDD At 20-year MDD At 20-year ADD	 7 L/s 10 L/s 5 L/s
Stored form	Liquid PACl
Stored quantity:	Sufficient volume for 25 days of operation at 5 L/s at a dose of 10 mg/L 110 kg of PACl or 375 L of solution

The PACl used to dose incoming raw water to the WTP (Section 4.3.2) and for residuals management as described above will be stored in the same chemical tank, for a total 8900 L of storage required for 25 days at the 20-year MDD.

4.4.3 Gravity Thickeners and Plate Settlers

The gravity thickener with plate settlers will remove the larger particulates from the residual waste water. The supernantant will gravity flow to a supernatant tank to be pumped to the head of the plant, and the settled sludge will gravity flow to the Wastewater Tank for offsite disposal. A single plate settler system is proposed, sized to treat operate 24 hours a day when the WTP is running at the 20-year MDD. The plate settler will only run when the WTP is in operation. The flow of recycled water to the head of the plant must be less than 10% of incoming raw water flows. It is proposed to treat the residual water at a rate that is equal to 6% of the incoming raw water flows. This will match the maximum 5% of incoming flows released as waste by the membranes, plus periodic releases to the MBT from other sources.

After being treated, this recyle water will be pumped from the supernatant tank back to the head of the plant at a rate that is equal to 6% of the flow rate of raw water entering the WTP. The pumping system for the supernantant tank will consist of a duty and standby pump. The tank will be sized to hold 30 minutes of supernantant from the gravity thickener as a safety measure.

Table 4-18
Plate Settler Design Criteria

Gravity Thickeners and Plate Settlers	
Number of units:	1 duty
Rise rate:	1 m/h
Target solids recovery:	85%
Target thickened sludge concentration	3%
Maximum outlet flow rate (supernatant) recycled to head of plant	10-year demand: 7 L/s 20-year demand: 10 L/s
Supernatant Storage Tank	
Tank capacity	30 minutes at 9 L/s 16 m^3

4.4.4 Wastewater Tank

Flows to the Wastewater Tank can be grouped into two categories. Waste that is produced on a regular or near-continuous basis, producing a regular flow to the wastewater tank; and waste that is produced in high volumes over a short period of time. It is valuable to distinguish between these two types of waste streams, as storage at the wastewater pump station must be capable to handle a worst-case scenario of all the short-term waste loads being sent to the wastewater tank at the same time. Waste in this tank will be gravity fed through two plug flow control valves in parallel (one duty, one standby), that move the waste offsite to the Town's existing sewer system. The tie-in to the sewer will be at Colonia Drive. The wastewater tank will be sized for the 20-year MDD conditions.

Table 4-19
Wastewater Tank Design Criteria

Wastewater Tank	
Continuously produced waste flows (20-year MDD)	DAF float sludge: 67 m^3 /day (max.) Gravity thickener sludge: 130 m^3/day (max.) Floor drains: 12 m^3 /day [1] Washrooms: 0.5 m^3 /day [2]
Short-term waste flows (20-year MDD)	
Daily Maintenance Washes	Waste generated per chemical: 5.2 m^2 Number of chemicals used per wash: 1-2 Trains cleaned per day: 3 Total waste: 31 m^3 /day
Monthly CIP	Waste generated per chemical: 5.2 m^3

Wastewater Tank	
	Number of chemicals used per clean: 2-3 Trains cleaned per day: 1 Total waste: 16 m^3 /day
Storage capacity	6 hours of operation at 20-year MDD
Maximum waste generation over 6-hour period	Continuous DAF float sludge: 17 m^3 Gravity thickener sludge: 33 m^3 Washrooms: 0.1 m^3 Floor drains: 3 m^3 Short-term Membrane maintenance clean: 31 m^3 Clean-in-place: 16 m^3 TOTAL: 100 m^3
Storage dimensions:	5.8 m x 5.8 m x 3.6 m deep Includes 0.6 m freeboard
Flow control valve sizing	Empty volume of tank in 6 hours 4.7 L/s

Notes:

1 – Floor drain flow estimate based on the continuous release of water from one chlorine analyzer (30 L/hr) and 8 turbidimeters (60 L/hr each).

2 – Washroom waste flow based on two staff being onsite full time, and each staff taking a shower at the WTP.

4.4.5 Overflow Pond

The existing overflow pond will receive overflow from the pre-treatment and buffer tanks should a malfunction of the WTP occur downstream of the pre-treatment tanks. The pond is also used by the Town to periodically drain the reservoir for cleaning, and will be used to periodically drain the DAF and buffer tank for inspections or cleaning.

Table 4-20
Overflow Pond Details

Overflow Pond	
Volume required	1 hour of operation at 20-year MDD 600 m^3
Existing storage volume	200 m^3

The existing overflow does not have enough capacity for its proposed use. To use the existing overflow pond with its existing dimensions, the WTP will need to shut down operations causing an overflow within 20 minutes of the error when running at the 20-year MDD.

4.4.6 Water Quality Monitoring

Continuous water quality monitoring will be required at certain points along the Arbutus WTP to verify effective performance of the treatment processes. The following table summarizes the recommended locations and parameters for continuous water quality monitoring among the various WTP processes:

Table 4-21
WTP Online Instruments

Water Quality Monitoring Location	Parameter
Screened Water	Turbidity pH
Post Pre-Treatment (Buffer Tank)	Turbidity pH Temperature
Post Membrane Filtration	Turbidity
Post Disinfection	Free chlorine (existing instrument)

4.5 PROCESS PIPING AND VALVING

For all above-grade water process piping, stainless steel AISI 316 L, Schedule 10S piping and fittings will be used. A 350 mm diameter pipe of this type will have a maximum working pressure of 310 psi. This will be suitable for all pressures anticipated through the WTP. In terms of considering flange class, the 150# flange has a maximum working pressure of 275 psi. The maximum working pressure in the WTP is anticipated to be 74 psi (52 m), while the transient analysis anticipated a worst-case surge pressure of 182 psi (128 m) from Stocking Lake along the raw water lines upstream of the pre-treatment tanks. Class 150# flanges will be appropriate for the WTP.

Schedule 80 PVC or CPVC process piping will be used for the chemical feed systems. CPVC piping will be specified for chlorine/hypochlorite solutions and for higher temperature applications.

Primary and large diameter water process isolation valving will be butterfly valves and, in some cases, gate valves. Material for these valves will be lined and coated ductile or cast iron body with bronze or stainless steel trim. Check valves and other types of valves will use the same construction. Smaller diameter process valves (50 mm and smaller) will be ball valves of stainless steel construction.

In the residuals area, sludge valving may include lubricated plug valves.

5 Water Treatment Plant Siting and Interconnections

5.1 CHANGES TO EXISTING INFRASTRUCTURE

The plant will connect to the existing water mains from Stocking Lake and Chicken Ladder as shown in the Koers buried works site plan in Appendix A. Key existing infrastructure that will be impacted by Phase II of the WTP are as follows:

- *Raw water flow meter and flow control valve chambers:* The Town has indicated that it is difficult to access and maintain the flow control valves in their current buried location. New flow control valves that will allow for a range of flow operation will be installed inside the WTP. The valves and equipment in the existing valve chambers will be replaced with pipe to route the raw water to their entry point into the WTP.
- *WTP Phase I building:* The Phase I building will remain to be used for housing the electrical equipment and chlorination system. The existing washroom will be removed to provide more room for electrical equipment. The existing chlorination equipment will be kept as is in the existing pump room and chlorine room.
- *Chlorination manhole:* The Town has expressed concern over having their point of chlorine injection inside a buried manhole. The point of chlorine injection shall be moved inside the WTP, and the existing chlorination manhole shall be abandoned.
- *Waste holding tank:* The waste holding tank shall be removed and replaced with the Wastewater Tank located west of the WTP. Washroom and sink waste will be sent to the Wastewater tank and ultimately go to the Town's sewer system.

5.2 WTP HYDRAULIC PROFILE

5.2.1 Raw Water Supply Mains

The Stocking Lake and Chicken Ladder raw water mains will not be upgraded at this time. If the Town decides to increase the size of their raw water mains, there is an opportunity to reduce the amount of dynamic (frictional) headlosses through the supply mains and recover the increased water pressure at the head of the plant as energy. Space has been left in the WTP to allow for the future inclusion of reverse turbines to recover this energy.

Water will gravity flow from Stocking Lake and Chicken Ladder to the head of the WTP. Flow to the plant will be regulated through the use of a flow control valve located on each of the two intake lines inside the WTP. The valve will also significantly reduce water pressure at the head of the plant to match the hydraulic gradeline of the open-to-atmosphere pre-treatment tanks. Pressure will be reduced to approximately 4 psi (3 m) upstream of pre-treatment. The pressure reducing valves will require anti-cavity trim to handle this level of pressure reduction. As part of our transient analysis of the two supply mains, hydraulic modelling was conducted that indicated that the pressure of water entering the WTP will be approximately 46 psi

(32 m) when either intake is drawing water at 125 L/s, and will be between 64 and 70 psi (45-49 m) at static levels. Figures 5-1 and 5-2 show the hydraulic model for the 125 L/s scenario from the Chicken Ladder intake to the WTP, and from the Stocking Lake existing PRV station to the WTP, respectively. Whether 46 psi or 70 psi, this is a significant amount of pressure to reduce to atmosphere through the flow control valves. Anti-cavitation trim must be included in the flow control valves to avoid cavitation damage to the valve and downstream piping. Singer and Cla-val have both indicated that they can provide flow control valves that can meet our pressure and flow conditions, while controlling cavitation inside the valve.

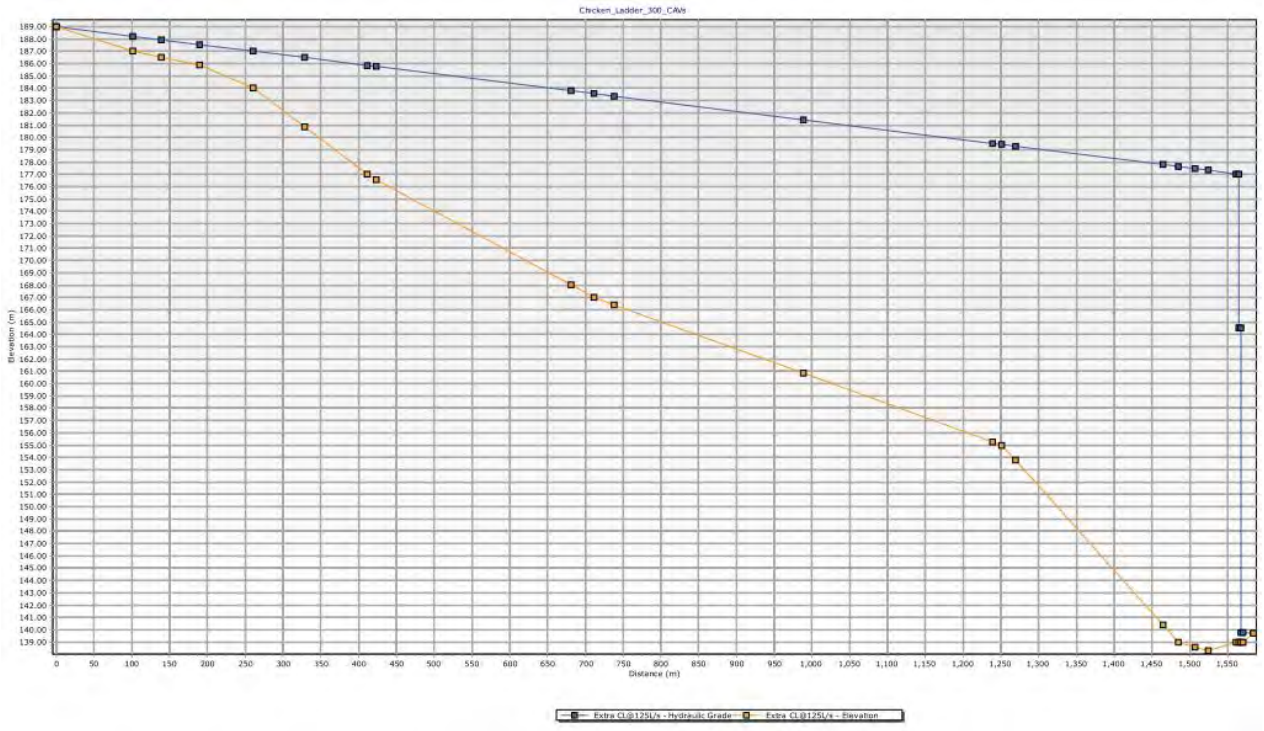


Figure 5-1. Supply Main Hydraulic Profile – Chicken Ladder (125 L/s)

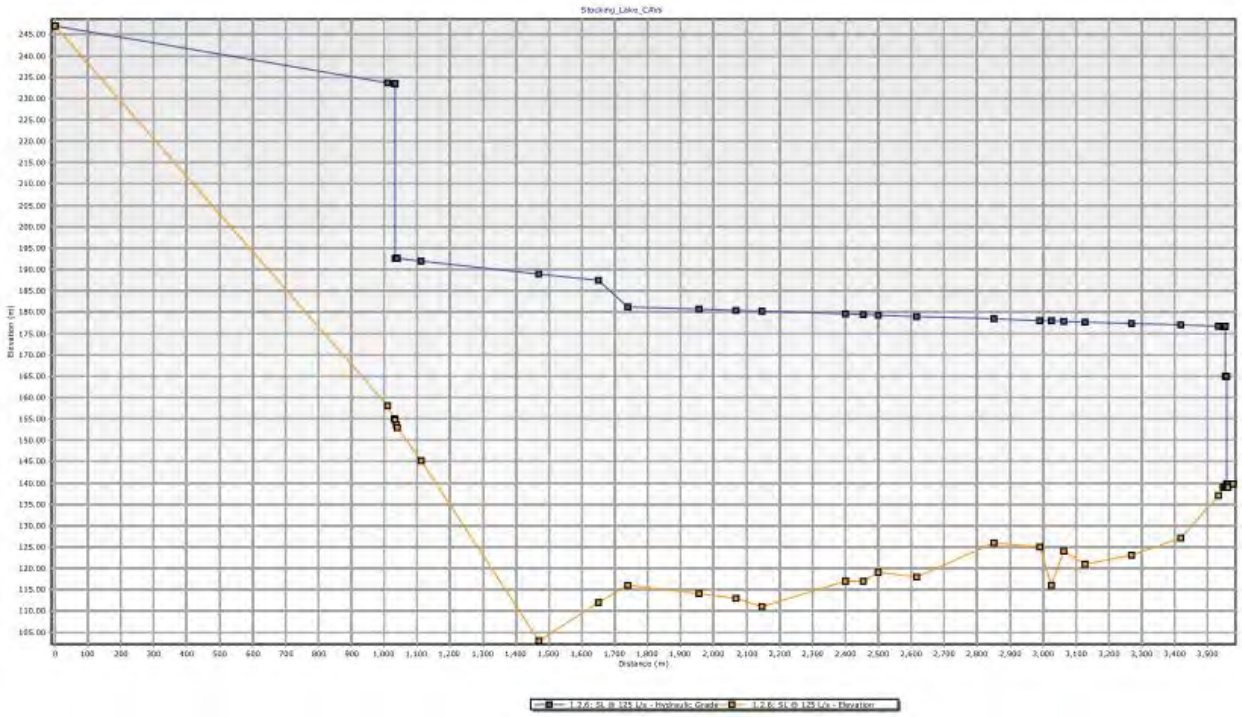


Figure 5-2. Supply Main Hydraulic Profile – Stocking Lake (125 L/s)

A hydraulic analysis was also conducted for the scenario where Chicken Ladder is providing 150 L/s to the WTP, or where Stocking Lake is providing 220 L/s. If no upgrades are made to the supply mains when running at these flows, water pressure entering the WTP is expected to be 45 psi (34 m) from Chicken Ladder or 20 psi (15 m) from Stocking Lake, reducing the risk of cavitation in the raw water flow control valves.

5.2.2 Raw Water Surge Analysis

A transient analysis was conducted, studying the potential for pressure waves along the supply mains for future flow demands, specifically 150 L/s from Chicken Ladder and 221 L/s from Stocking Lake. Without proper surge mitigation in place, the Chicken Ladder main will be at risk of pressure waves along the supply main, including instances of negative pressure. Stocking Lake was not anticipated to encounter negative pressure conditions, but because of the relative small diameter in some sections of the supply main, the Stocking Lake main is anticipated to experience significant increases in pressure during valve closures.

To mitigate these surge conditions at the WTP, the following recommendations were made and will be incorporated into the WTP design:

- Include a 100 mm pressure (surge) relief valve at the head of the WTP on each of the two incoming supply mains – to open at 85 psi (60 m) on Chicken Ladder and 182 psi (128 m) on Stocking Lake. The relief valves will send excess water to the overflow pond.
- Set the minimum closing time of the flow control valves in the WTP to 60 seconds for Chicken Ladder and 120 seconds for Stocking Lake. In this design, it is proposed that both flow control valves be set to have a 120 second closing time to accommodate the ability to manually route water from the intakes through either of the two raw water mains in the WTP.

The report also asked the Town to confirm that the existing air valves along the Chicken Ladder supply main are a minimum 25 mm in size to reduce the risk of cavitation along the supply main.

It was also noted that the Town may wish to investigate the resilience of the existing PRV station along the Stocking Lake supply main. If transient pressures are determined to be a concern at the PRV station, the Town should consider adding an air valve and pressure release valve downstream and upstream of the PRV, respectively.

5.2.3 Pre-treatment

Water will then gravity flow from the rapid mixing tank, through the two flocculation tanks, and through the DAF system to the buffer tank.

5.2.4 Buffer Tank, Membranes and Reservoir

Water will then be pumped from the buffer tank to push water through the membrane system up to the reservoir. After the membranes, an inline booster pump will provide sufficient head to drive the filtered water through the rest of the WTP up to the reservoir. When the plant capacity is increased to the 20-year MDD, up to 1.8 m of dynamic headloss is anticipated from the membranes to the inlets of the reservoir. The Arbutus Reservoir has a top water level of 163 m, approximately 23 m higher than the elevation of the WTP site. The membrane system is required under their supply contract to be able to provide 27 m of total dynamic head downstream of the membranes, which will be sufficient to meet the static and friction head requirements.

Water will gravity flow from the reservoir to the Ladysmith distribution system.

5.2.5 Overflow and Residuals

Overflow water will flow by gravity to the overflow pond. Floor drains, washroom connections, and membrane chemical cleaning waste will gravity flow to the wastewater tank, located at an approximate elevation of 126 m (bottom of tank elevation).

Membrane hydraulic cleaning waste and the drains from the pre-treatment and DAF tanks will gravity flow to the MBT located adjacent to the wastewater tank at a ground elevation of 126 m. This waste will then be

pumped to the plate settler/gravity thickener. Settled sludge will gravity flow to the wastewater tank and the supernatant will be pumped to the coagulation/rapid mixing tank at the head of the pre-treatment system.

Waste in the wastewater tank will gravity flow to the existing sewer system located on Colonia Drive. Flow rates will be controlled by a flow limiting valve by the wastewater tank. The route from the manhole to the sewer system decreases in elevation to less than 99 m, then steadily increases back up to a manhole insert elevation of 110.3 m. Colonia Drive has a surface elevation of 114.6 m at this point.

6 Preliminary Design Details

6.1 SITE LAYOUT

The proposed overall site layout is shown in Appendix A. The site is surrounded on most sides by right of ways and properties owned by Fortis, BC Hydro, and the Stz'uminus First Nation. The site was originally selected during Phase I of the WTP due to its proximity to the Arbutus Reservoir and a location where the Chicken Ladder and Stocking Lake supply mains would converge to a single location. There is sufficient space remaining on site to proceed with Phase II of the WTP, and to further expand the WTP past the 20-year horizon.

When the WTP has met its 20-year projected demands, the capacity of the WTP can be expanded by building a third DAF tank outside of the WTP. It is anticipated that expanding the buffer tank will not be required. Space is already available inside the WTP to add a fourth membrane train. With these upgrades the WTP's capacity could be expanded to 221 L/s.

To further increase the capacity of the WTP, a fourth DAF train could be added outside of the existing WTP structure, and the membrane system would need to be replaced with a new membrane system with a more efficient footprint. It is anticipated that by the time the WTP is ready to be sized beyond 221 L/s, in approximately 2058, membrane technology will have further improved such that higher capacity membranes will be available that will fit in the space occupied by the current membranes. As noted in Section 4.3.4, expansion of the DAF system can be deferred if a more aggressive DAF loading rate can be reliably used.

6.2 UTILITIES AND SITE SERVICES

6.2.1 Incoming Power Service

The Arbutus WTP receives power from a BC Hydro (BCH) service located on Colonia Drive. The power requirements for Phase II of the WTP are considerably larger than the current power demand. An application of the new power requirements will be submitted to BCH. This increase in demand is likely to result in BCH having to increase their service transformer. We require updated load requirements from the recommended membrane vendor. Once these are provided, we will complete the total electrical load estimates for the WTP and the application to BCH can proceed.

The existing cabling from the transformer to the plant should be adequate for the increased loads. This will need to be confirmed during detailed design.

6.2.2 Backup Power Supply

The Arbutus WTP is a vital link in supplying potable water to Ladysmith and surrounding communities. Supply must thus be maintained during both normal short-duration interruptions in the utility power supply,

as well as during longer emergency situations, such as after a seismic event. Thus, the Arbutus WTP requires sufficient onsite power to continue to treat their water to BC's drinking water standards.

A generator and fuel tank will be installed outside, onsite, sized to provide sufficient power for only the treatment process and related pumps to operate at their design capacity during a power loss event. The fuel tank for the generator will be sized to provide 24 hour run time for the generator loads.

6.2.3 Incoming Telephone Services

The existing Arbutus WTP Phase I does not have any telephone service wired to the facility. A telephone and internet connection will be established using a fibre optic cable (minimum of 12 fibers) that will connect to the Town's network at the Public Works Yard.

6.2.4 Fire Protection

A review of the 2012 BC Building Code has indicated that sprinklers are not required at the WTP. Smoke alarms will be installed and we will designate areas for the Town to keep fire extinguishers on site. The option of installing a fire hydrant on site will considered as part of the next stage of design.

6.3 ROADS, PARKING AND SECURITY

To match the existing on-site roads and parking, roads and parking on the WTP site property will be added to provide access to all of the loading/unloading points of the WTP, both for materials and equipment delivery, and to provide access to staff and visitor parking.

No upgrades to the existing sand and gravel access roads outside of the site boundaries are planned as part of this design.

6.3.1 Plant Security

Security will consist of new gates and fencing around the WTP and intrusion alarms.

6.4 WATER TREATMENT PLANT LAYOUT

A preliminary layout of the WTP is provided in Appendix A.

6.5 PROVISION FOR FUTURE TREATMENT PROCESSES AND EXPANSION

The WTP layout includes a spare chemical room in case an additional chemical is required to enhance the treatment of residuals in the MBT.

6.6 SITE PREPARATION

Site preparation for the proposed water treatment plant site will consist of the following:

- Some clearing and grubbing will be required along the western portions of the water treatment plant site.
- There are some old stripping materials that were wasted in the northwest corner of the site when the original open reservoir was excavated. These must be removed before the proposed waste handling facility can be constructed.
- Some of the existing fill materials that are located within the old open reservoir, which also fall within the footprint of the proposed treatment plant, will be removed, re-processed (if possible), and re-compacted prior to construction of the treatment plant.
- Excess materials will be generated during excavation of the lower floor levels within the proposed building. These materials will be removed from site as there are no significant fill areas available on this project. It may be possible to use these excess excavated materials to help improve certain portions of the existing access road from Battie Drive.
- Some of the deeper building excavations will encounter solid rock, which will need to be removed by drilling and blasting. Depending on how close the solid rock is to the existing high pressure gas pipeline, located to the west, some of the solid rock may have to be removed using a large hydraulic rock breaker,
- There will be some excavation cuts required along the western edge of the site to accommodate the proposed access driveway that will be constructed around the new water treatment plant.

6.7 STORMWATER DRAINAGE

Some site drainage improvements will be necessary on this project. Along with roof drainage, local surface drainage from the site will be controlled and directed to the southeast to minimize any potential impacts to Holland Creek that may result from erosion, sedimentation, or accidental chemical spills around the proposed water treatment plant. Surface drainage around the site will be controlled using swales, ditching, and culverts as required.

Perimeter drainage from any deep foundations that will be installed around the proposed building will be directed to the northwest as daylighting low elevation drains to the southeast will not be economically feasible due to the topography of the ground.

The overflow piping from the Arbutus Reservoir will be extended and diverted around the new water treatment plant. The reservoir overflow pipe will be directed towards the existing overflow pond located in the southeast corner of the site. Some improvements will need to be made to the existing pond.

6.8 YARD PIPING MATERIALS AND STANDARDS

Site piping around the proposed water treatment facility will consist of the following:

- A new raw water inlet piping connection will be made to the existing 400 mm dia. PVC raw water supply pipe from Chicken Ladder. An exterior flushout and shut-off valve will be added to this piping connection and located outside the plant.

- A new raw water inlet piping connection will be made to the existing 450 mm dia. PE raw water supply piping from Stocking Lake. An exterior flushout and shut-off valve will be added to this piping connection and located outside the plant.
- The strainers, control valves, and meters that are located in the existing underground chambers will be decommissioned, as these were always meant to be temporary.
- The treated water supply main to the Arbutus Reservoir(s) will include a Tee with two valved branches – one for the existing reservoir and one for a future reservoir inlet supply pipe. The branch to the future reservoir will contain a blind flange on the valve. The treated water supply main to the existing Arbutus Reservoir will tie into the blind flange located on the existing 400 mm dia. reservoir inlet cross.
- The outlet pipe from the existing reservoir will be diverted around the new water treatment plant. The new outlet pipe will connect to a blind flange that is located on the existing 500 mm dia. cross. The new outlet will include a tie-in connection that will allow a second duplicate 500 mm dia. reservoir outlet pipe to be added for a second reservoir in the future. The new reservoir outlet pipe will be designed to have a flow meter added so that instantaneous system demands can be monitored on a continual basis.
- After the meter, the reservoir outlet pipe will split at a Tee to form two branches, one to supply the north and central distribution systems to the west and one to supply the south distribution system to the east. This Tee branch will be fully valved with three valves to enable complete operational flexibility.
- The outlet pipe that supplies the north and central distribution systems will be designed with a new tie-in that replaces the existing Tees that are located down beside the old abandoned chlorination building. The design of these tie-ins will take into account the future replacement of the downstream distribution mains.
- The new outlet connection that supplies the south distribution system will be designed with a new tie-in where the existing 300 mm dia. PVC supply main meets the existing 350 mm dia. PE supply main.

In addition to the water piping required on this project there will be some buried waste lines that will run between the water treatment plant and the residuals handling facility that will be located in the northwest corner of the site. Some waste lines will consist of gravity pipes and some will consist of pressure pipes. The size of the waste lines is expected to be in the range of 100 to 200 mm dia.

6.9 GEOTECHNICAL DESIGN

A geotechnical assessment of the site was conducted as part of construction of Phase I of the WTP. An assessment for the impacted areas that extend beyond the original 2011 assessment is currently underway for the WTP site and the sewer main route from the WTP site to the tie-in point at Colonia Drive. The 2011 geotechnical report included the following highlights:

- The WTP is located at the site where the original, open-pit Arbutus reservoir was built. Part of the site was filled in when the concrete tank reservoir was constructed nearby.

- The site is a layer of relatively compact mixed rock fill and silty sand with occasional boulders and some limited disbursed organic content, sitting on bedrock. The thickness of the fill material ranged from 2 m near the edges of the original reservoir, to 4.7 m at the centre of the reservoir's old excavation.
- No groundwater was detected in the test pits that were excavated to the bedrock layer.
- Recommended site preparation included excavation to expose dense till and/or bedrock. Engineered fill will be required to re-establish grades.
- The report identified opportunities to repurpose some of the existing fill on site.

A geotechnical report is being prepared to provide recommendations for site preparation, trenching, and foundation for the expanded use of the WTP site for Phase II and for the sewer main route.

6.10 STRUCTURAL

6.10.1 Structural Codes and Standards

For the conceptual design, structures were designed to conform to the British Columbia Building Code (BCBC) 2012. It is likely that the National Building Code of Canada (NBCC) 2015 will be adopted by the local authorities at the time the contract documents are issued for building permit. Therefore, we will ensure the design of the water treatment plant conforms with the more stringent provisions of BCBC 2012 or NBCC 2015.

The importance category classification for all water treatment and storage facilities is Post-disaster in accordance to BCBC 2012 Table 4.1.2.1. Post-disaster buildings are essential to the provision of services and must continue to be functional and fit for immediate occupancy following a seismic event.

Structural design is performed in accordance with the following standards:

- Concrete Design to CSA A23.3-14 – Design of Concrete Structures
- Steel Design to CSA S16-14 – Design of Steel Structures
- Timber Design to CSA O86-14 – Engineering Design in Wood
- Masonry Design to CSA S304-14 – Design of Masonry Structures
- ACI 350-06 and other standards appropriate for the Buffer Tank and other fluid retaining structures

6.10.2 Structural Design Parameters

The following loading parameters are used in the design of structures:

Live Loads

The live loads for the different floor and roof uses are as follows:

Building	Floor/Roof Use	Pressure
Main Process Building	Floor Slab for Vehicles Exceeding 9000 kg gross weight	12.0 kPa
Main Process Building	Stairs/Platforms	4.8 kPa
Administration Building	Office	4.8 kPa
Administration Building	Mechanical/Chemical Storage Rooms	4.8 kPa
All Buildings	Roof	1.0 kPa

Snow Loads

Snow loads shall be based on provisions from BCBC 2012, Cl. 4.1.6.2.

	Return Period	Pressure*
Snow, S_s	1/50	2.4 kPa
Rain, S_r	1/50	0.4 kPa

*Pressure values are obtained from Table C-2 from NBCC 2015.

The specified snow is calculated using the formula:

$$S = I_s \cdot [S_s \cdot (C_b \cdot C_w \cdot C_s \cdot C_a) + S_r]$$

I_s = Importance Factor for snow load, 1.25 for ULS and 0.9 for SLS (BCBC 2012, Table 4.1.6.2.)
S_s = 1-in-50 year ground snow load, 2.4 kPa
S_r = 1-in-50 year ground snow load, 0.4 kPa
C_b = Basic snow load factor, 0.8 (BCBC 2012, Cl. 4.1.6.2. (2))
C_w = Wind exposure factor, 1.0 (BCBC 2012, Cl. 4.1.6.2. (3))
C_s = Slope factor, 1.0 (BCBC 2012, Cl. 4.1.6.2. (5))
C_a = Shape factor, 1.0 (BCBC 2012, Cl. 4.1.6.2. (8))

Snow buildup loads will also be considered, particularly for the stepped roof locations.

Wind Loads

Wind loads shall be based on provisions from BCBC 2012, Cl. 4.1.7.1.

	Return Period	Pressure*
Wind, q	1/10	0.31 kPa
Wind, q	1/50	0.40 kPa

*Pressure Values are obtained from Table C-2 from NBCC 2015.

The specified external wind pressure or suction is calculated using the formula:

$$p = I_w \cdot q \cdot C_e \cdot C_g \cdot C_p$$

I_w = Importance Factor for wind load, 1.25 for ULS and 0.9 for SLS (BCBC 2012, Table 4.1.7.1.)
q = 1-in-50 year reference velocity pressure, 0.40 kPa
C_e = Exposure factor, 1.05, based on a reference height, h = 12.75m (BCBC 2012, Cl. 4.1.7.1. (5))
C_g = Gust effect factor, 2.0 (BCBC 2012, Cl. 4.1.7.1. (6))
C_p = External pressure coefficient, varies

Site Response Spectrum

The 5% damped spectral acceleration for a 2% probability of exceedance in a 50 year probability level is determined using the Earthquake Hazard Calculator from http://www.earthquakescanada.ca, using coordinates of 48.9804 North and 123.8291 West.

The seismic hazard values as per National Building Code of Canada 2015 are as follows:

$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	$S_a(5.0)$	$S_a(10.0)$
1.102	1.024	0.589	0.352	0.110	0.039

The seismic hazard values as per British Columbia Building Code 2012 are as follows:

$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$
1.061	0.723	0.362	0.182

In accordance to the Geotechnical Report from Levelton Consultants Ltd., dated December 20 2011, the site for Phase I of the Arbutus Water Treatment work is classified as Site Class C with undisturbed native soils/bedrock. The foundation factors or site coefficients for Site Class C is 1.0 and unmodified for all fundamental periods of vibration. The Site Class and soil properties for Phase II of the work will be confirmed by a Geotechnical Engineer during detailed design.

Seismic Design Parameters

For Post-Disaster Structures, the structures must be designed for the following criteria:

- I_E = Importance Factor for earthquake loads, 1.5 for ULS and 1.0 for SLS (BCBC 2012, Table 4.1.8.5)
- R_d = 2.0 or greater (BCBC 2012 Cl. 4.1.8.10. (2))
- Not have any irregularities conforming to Types 1, 3, 4, 5, 6 and 7 as described in BCBC 2012 Table 4.1.8.6
- Interstorey drift at any level limited to 0.01 h_s (BCBC 2012 Cl. 4.1.8.13. (3))

The seismic force resisting system is designed at a minimum as a limited ductility moment resisting frame in the short direction with an R_d = 2.0 and an R_o = 1.3 and as a limited ductility braced frame in the long direction with an R_d = 2.0 and an R_o = 1.3.

Crane Loads

A 10-tonne capacity top running single box girder bridge crane is currently considered for crane loads.

6.10.3 Structural System Descriptions

The Main Process Building consists of a single-storey Pre-Engineered Steel Building with moment resisting frames in the transverse direction and braced frames in the longitudinal direction of the building. The Pre-Engineered Steel Building columns and rafters are straight or tapered depending on the Pre-Engineered Steel Building supplier and the clearance requirements to nearby equipment and tanks. The 10-tonne crane runs for the full length of the building and is supported on crane runway beams resting on steel corbels extending inwards from the columns of the Pre-Engineered Steel Building. The building cladding and envelope are supported on roof purlins and wall girts running outboard of the structure for ease of detailing the braced frame connections. The Main Process Building is raised off from the floor slab with a concrete curb on a thickened concrete raft slab.

For Option A, the Administration Building adjacent to the Main Process Building is a single-storey Pre-Engineered Steel structure connected at mid-height of the Main Process Building. The Administration Building is supported on individual steel columns on one half of the building and supported off the Main Process Building columns on the other half of the building. The Administration Building is supported laterally by the Main Process Building in both the transverse and longitudinal direction. The interior partitions inside the Administration Building are aligned with the Pre-Engineered frames where possible for lateral support. Like the Main Process Building, the Administration Building is raised off from the floor slab with a concrete curb on a thickened concrete raft slab. The cost estimates provided in Section 7 are based on Option A.

For Option B, the Administration Building adjacent to the Main Process Building is an independent single-storey wood frame structure seismically separated from the Main Process Building. The Administration Building is conventionally framed with wood stud walls and engineered wood roof joists. Where the headroom clearance in the Administration Building is high, such as the soda ash mechanical room, LSL tall wall studs can be specified in lieu of dimensional lumber studs. The Administration Building is supported laterally by nailed shear walls in both the transverse and longitudinal direction. An advantage of using a wood frame structure over a pre-engineered structure is the flexibility in the design to accommodate varying building geometry and building openings. Option B is being considered as an alternative if the design of the Administration Building can be built more cost-effectively than the Pre-Engineered building. Refinement of Option B and a comparison of the two options will be finalized in the next stage of design.

The existing Phase I Chlorination Building is located adjacent to both the Main Process and Administration Building. The existing structure is a plywood sheathed roof supported on engineered wood I-Joists on masonry block walls. The existing roof will require an upgrade to account for additional snow drift loads from the Main Process and Administration Building. The upgrade could consist of reinforcing the existing

roof members and installing new members and connections to support the added snow load. The upgrade scheme is currently preliminary and will be finalized during the detailed design phase. The Main Process Building and Administration Building are seismically separated from the Chlorination Building by a sufficient gap to account for lateral displacements of the buildings during a seismic event. An expansion joint cover material will be used to cover the gap as appropriate.

The Residuals Building and its related tankage (MBT, wastewater tank, and supernatant tank) are located away from the core of the Water Treatment Plant on the slope at the south end of the site. The Residuals Building is a single-storey steel braced frame building supported on W-Flange beams and columns. Like the core of the water treatment plant, the Residuals Building and the residual tanks are supported on concrete raft slabs. The soil surrounding the storage tanks are retained by the concrete retaining walls at the perimeter of the concrete raft slabs.

6.11 ARCHITECTURAL

The architectural design will generally be limited to ensuring that the WTP will have a building envelope that meets the Town's needs, including appropriate finishes and insulation, and appropriate egress. Additional architectural features, such as natural lighting, shall be incorporated where economically feasible.

6.12 LANDSCAPING

The site is previously disturbed with some trees and shrubs in the northwest corner of the property. The design of the landscape will attempt to minimize the amount of tree and shrub removal. Overall, the site will be landscaped to permit ease of access around the site.

The environmental assessment is currently underway.

6.13 BUILDING MECHANICAL

6.13.1 Heating, Ventilation and Air Conditioning

All spaces will be provided with the capability of continuous ventilation, with varying airflow rates based on occupancy or usage. The ventilation will be provided to maintain suitable air quality for each space but also functions to reduce condensation, provide cooling and/or to expel contaminated air. Most spaces will be ventilated by a forced air system using ductwork and strategically located diffusers. For greater effectiveness and efficiency, supply grilles will be located at around 2.4 m elevation and lower where practical. Supply air will typically be directed towards the floor, while relief, exhaust, and return air will typically be drawn from higher elevations of the conditioned spaces. Outside air ventilation fans and/or dampers may be turned off/closed during unoccupied periods when there is no call for cooling or dehumidification.

Most spaces will have a minimum winter ventilation airflow rates to minimize heating energy usage, and increased flow rates to provide outside air cooling as the ambient temperatures increase, in the summer. The control room and lunch room areas will be fitted with air conditioning.

Depending on the space occupancy or building usage, heating will be provided for freeze protection, condensation prevention or occupant comfort as required. Most process areas and chemical rooms will be heated using electric unit heaters or wall heaters.

At this stage, it is deemed that energy recovery units will not be cost effective due to the generally low space heating design setpoints, (affording limited energy recovery due to the narrower temperature differences between indoor and outdoor air temperatures) in the process rooms, and due to the already efficient heat pump systems that will be in the control and lunch room. This and other energy saving options can be evaluated in the detailed design using energy modelling software.

The indoor and outdoor design temperatures are listed below:

Outdoor Design Temperatures (from BC Building Code)

Winter Design	-9°C (January 1% Design Temp.)
Summer Design	27°C db, 19°C wb (July 2-1/2% Design Temp.)

Indoor Design Temperatures

Winter Design

Process Room	10°C
Mechanical Room	10°C
Control Room/Lunch Room	20°C with 5°C night set-back
Soda Ash Room	10°C
Pacl Room	10°C
Washroom/Shower/Locker	20°C

Summer Design

Process Room	24°C to 34°C depending on outdoor air temperature.
Mechanical Room	24°C to 34°C depending on outdoor air temperature
Control Room/Lunch Room	22°C
Soda Ash Room	24°C to 36°C depending on outdoor air temperature
PACl Room	24°C to 36°C depending on outdoor air temperature
Washroom/Shower/Locker	Not temperature controlled.

6.13.1.1 Heating Fuel

Natural gas will not piped to this facility and it is neither desirable nor economical to truck in other fuels such as oil or propane, for heating. The logical choice then for fuel source is electricity.

6.13.1.2 Process Room

The open process areas in the water treatment building will be heated with radiant floor heat using heated glycol from the heating plant. An air-handling unit (fan coil unit) will supply ventilation air to the open space. The fan speed will be adjustable to supply anywhere from the minimum required for ventilation, to the maximum required for dehumidification. The outside air will be filtered, as well as tempered as required using an electric heating coil. Unit heaters will be provided in the process area to handle the envelope losses when the air handling unit is off.

Good air circulation in large spaces requires large airflows. Proper air circulation will minimize temperature and humidity gradients in the various spaces. A few large-diameter, propeller type circulating fans will be provided to mitigate the stratification issue. These fans are capable of providing large amounts of air circulation with very little power. This strategy also eliminates the need for additional large air-handling units and extensive ductwork. Eliminating or minimizing the ductwork is necessary to avoid interference with the overhead crane. These fans will be installed in the ceiling of the operating floor. Variable speed switches will be used to control the speed of the fans. The fans will operate continuously.

6.13.1.3 Mechanical Room

An in-line variable speed supply fan will supply outside cooling air to the room. The fan will be cycled and speed regulated to maintain the room temperature between 24°C and 32°C, depending on outside air temperature.

A unit heater, automatically controlled from a wall thermostat, will provide the required heating to maintain the space desired temperature.

6.13.1.4 Control Room, Lunch Room, Locker, Shower and Wash Room

The control room and lunch room will receive continuous ventilation during occupied hours. A supply fan will distribute outdoor air to both rooms via ductwork. Upstream of the supply fan will be a filter box to filter the outdoor air and a duct heater to temper the outdoor air during the cold months.

A split heat pump system with one outdoor condensing unit and two indoor fan coils (one for each room), will provide supplemental heating in winter and air conditioning in the summer.

The lunch room will have a small, timer controlled exhaust fan above the microwave for exhausting any food odours. The shower room, locker room, and washroom will each be fitted with an exhaust fan, manually controlled by a wall timer switch. Make up air to replace exhausted air, will enter through door

grilles of each of the three rooms. A ceiling mounted electric radiant heater will be provided in the shower room. It can be activated from a wall timer whenever additional heat is desired.

6.13.1.5 Soda Ash Room

The soda ash room will be ventilated by a dedicated in-line supply fan, fitted with an electrically commutated (EC) motor. This allows the fan speed to be simply adjusted using simple controls. A wall temperature controller will vary the speed from minimum in winter to maximum as the space temperature increases beyond the cooling setpoint.

A unit heater, automatically controlled from a wall thermostat will provide the required heating to maintain the space setpoint.

6.13.1.6 PACl Room

The PACl room will be ventilated by a dedicated in-line supply fan, fitted with an EC motor. This allows the fan speed to be simply adjusted using simple controls. A wall temperature controller will vary the speed from minimum in winter to maximum as the space temperature increases beyond the cooling setpoint.

A unit heater, automatically controlled from a wall thermostat will provide the required heating to maintain the space setpoint.

6.13.2 Domestic Water and Plant Service Water

An existing distribution main from the Arbutus Reservoir passes close to the WTP. A connection will be made to the existing main to provide treated water for the WTP for domestic water use and plant services including strainer flushing, membrane chemical and hydraulic cleanings, soda ash solution makedown, and hose connections. A booster pump will be installed to provide sufficient pressure to the processes and service lines.

Hot water for the washroom sink and shower, as well as to provide tempered water to the emergency eyewash and showers, will be provided using electric hot water tank(s). In accordance with the BC Plumbing Code, washroom plumbing fixtures will be “low flow” models to meet or exceed the regulations.

6.14 ELECTRICAL

6.14.1 Variable Speed Drives

Variable frequency drives (VFDs) will be used for the membrane permeate pumps, the DAF recycle pumps, the MBT recycle pumps, and the rakes for the DAF and lamella plate settler systems. VFDs will also be used to set the mixing speed in the rapid mixing and flocculator tanks, and to control the speed that the skimmers will remove float sludge from the DAF tanks. One variable speed drive is provided per motor where variable speed is designated.

The supply power voltage will be 600 VAC. The control voltage shall be 120 VAC. Analog signals shall be 4-20 mA from the PLC system. VFDs will be supplied by the vendors of the various systems, and this equipment will be located in the main section of the plant local to the pumps being controlled.

6.14.2 Motor Starters

Motors not controlled by VFDs will be controlled by full voltage, non-reversing (FVNR) starters. Starters will be provided by vendors of the various systems (DAF, membranes, etc.) as part of their control cabinets, and will be located in the main portion of the plant. Motor starters will be 600V, 3-phase, with 120V control circuits, complete with appropriately sized overloads, and manual reset pushbuttons on the exterior of the control cabinet.

6.14.3 Motor Control Center (MCC)

Additional sections will be added to the existing 600V, 600A MCC in the electrical room supply the new equipment. Space in the MCC is limited to two (2) additional vertical sections, to conserve space, the MCC will feed 600V central distribution panels (CDP) for the equipment such as the DAF and the membranes. The 600V CDPs will contain individual protection for the motor loads, and provision for future motors to be added.

A new 400A transfer switch will be installed in the MCC to accommodate the standby generator.

6.14.4 Lighting

Lighting for the plant will all be energy efficient LED fixtures. Due to the large size of the building, general lighting will be provided at the ceiling height, above the crane. This will provide the plant with overall lighting levels of approximately 300 lux. Using LED fixtures will reduce difficult maintenance of replacement because the fixtures have a 20-25 year life span.

Supplemental task lighting will be provided in other areas of the plant where additional light will be required. This lighting will be installed on and around equipment and walkways, with manually controlled switches.

Exterior lighting will be minimal, and located above access doors only. These lights will be controlled by daylight sensors.

The ASHRAE standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings, does not specifically address requirements for water treatment plants. Principles of this standard such as power density and lighting controls will be applied to the lighting design where it is reasonable and safe to do so.

6.15 INSTRUMENTATION AND CONTROLS

The following confirms the instrumentation and controls design criteria and concepts. Refer to the Control Philosophy in Appendix B for more details.

6.15.1 Plant Control System

The plant control system is comprised of a compatible overall plant control system and vendor supplied packages for the following systems:

- Pre-treatment and DAF
- Membrane system
- Soda ash bulk handing hopper

Plant control consist of Programmable Logic Controllers (PLC) that control plant process and Human-Machine Interfaces (HMIs) that provide monitoring, operator adjustable setpoints, and operator control of the plant. The main plant control room will contain at least one HMI using PCs and one work station PC for configuration of HMIs and PLCs. The control panel and 'plant floor' operator interfaces located in the WTP will be panel mounted touchscreens.

Heating and cooling will not be controlled by the HMIs in the control room. Instead, heating and cooling will be controlled by temperature setpoint panels in the different rooms of the facility.

Communication between the various control system packages and the WTP PLC is via industrial Ethernet. Where possible, all PLCs shall be Allen-Bradley, with on-board support of the A-B Ethernet/IP protocol. Network hardware will be selected for suitability in the industrial environment, for example, N-Tron or Sixnet Ethernet switches. The selection of Allen-Bradley, N-Tron and Sixnet is based on what is currently used or is readily compatible with the communication packages used in the Town's new Wastewater Treatment Plant.

The control room HMIs will be configured to provide:

- Graphical displays for monitoring and controlling the WTP.
- Alarm reporting and logging capabilities.
- Historical information archiving and trending functions.

The workstation PC will provide:

- PLC configuration and programming.
- HMI configuration.
- File and configuration management and printing (documentation).

In addition, the control system will provide remote communication services to SCADA for remote access services. A fibre optic cable connecting the WTP the Ladysmith Public Works Yards will be complete as part of this project, and allow operators at the Yard to receive status and archive output from the WTP.

6.15.2 Process Instrumentation

All analog process instruments will use 4-20 mA DC signals wired to a PLC. Transmitters will have local indication on the instrument. If desired, an instrument bus system, such as Profibus, DeviceNet or Foundation Fieldbus can be designed, rather than the traditional 4-20 mA point to point wiring method. Bus systems allow for reduced wiring, while providing significantly more information about the status and health of the instruments on the bus.

All discrete I/O signals will be configured to use 120 VAC control voltage.

6.15.3 Equipment Control Philosophy

Motorized equipment will be controllable in either manual or auto modes. Motorized valves will have local/remote control and open/close selector switches on the actuators. Pumps and drives will have hand/off/auto selector switches on the MCC compartments in the electrical room. Vendor-supplied packages are provided with their own control panels, which will have various manual and auto control capabilities. VFDs will have keypads mounted on their enclosure doors for control, configuration and diagnostics.

6.15.4 Alarm Philosophy

The PLC control system will generate alarms and display them on the HMIs. The operator interfaces and control panels will include audible alarm annunciation, time stamping, and prioritization of alarms. Designated plant alarms will be transmitted to SCADA for notification.

6.15.5 Remote Access

The following is proposed and will be discussed with the Town during the next stage of design:

- The control system provides the WTP operators with various methods to access real-time, historical, and supervisory information from the facilities control room. The operators will also be able to adjust control setpoints, and acknowledge and reset alarms from the control room.
- The SCADA system will be used to access real-time process information from the WTP at the Public Works Yard. From the Yard, Town staff will be able to see the current status of the WTP, access historical information, and acknowledge or reset alarms. We will also provide the Town the ability to adjust setpoints from the Public Works Yard, in case adverse weather conditions make the WTP inaccessible and operation at the WTP must be adjusted until it is safe to access the WTP site.
- The display screens at the Public Works Yard will be identical to the WTP workstations.

- The membrane system may require internet access as part of the support services provided by the vendor. It is proposed that information from the membrane PLC be transferred via the new fibre optic cable to the Public Works Yard to access the internet. The Town's firewall and protection protocols will need to be discussed before this feature can be implemented.

7 Cost Estimates

7.1 BASIS OF CAPITAL COST ESTIMATES

The direct costs are considered to represent costs as quoted up to September 2017. The estimates presented herein include the following allowances:

- Direct Construction Costs – as estimated. Includes 5% PST
- Contractor Mobilization, Overhead and Profit – 15% of Division Construction Costs
- Design Contingency – 10% of Construction Cost
- Construction Contingency – 5% of Construction Cost
- Design and Engineering Fees – As per Associated Engineering's October 31, 2016 proposal
- Inflation/Escalation - 2% of above costs assuming mid-point of construction occurs in August 1, 2018 (based on 2% per year inflation)

The estimates are based on the design as described in this report and as shown in Appendix A. The cost estimates include $50,000 allowance for BC Hydro to upgrade the transformer on Colonia Drive, and a $40,000 allowance to retain a Systems Integrator to program the WTP PLC and HMI. The capital cost estimates do not include any upgrades to the Arbutus WTP access roads, or the implementation of any real-time water/flow monitoring at the Chicken Lake or Stocking Lake intakes.

7.2 BASIS OF OPERATION AND MAINTENANCE COST ESTIMATES

Table 7-1 lists the assumed unit costs and quantities used to calculate the WTP annual costs. It was assumed that two full-time staff would run the WTP. Chemical and power costs were based on the 5-year ADD (57 L/s) and an average chemical dose as identified in Section 4.

Table 7-1
Unit Costs

Description	Units	Unit Cost	Quantities
Lead Operator	Hr	$56	2080 hrs/yr
Shift Operator	Hr	$56	2080 hrs/yr
Maintenance Staff	Hr	$56	2080 hrs/yr
Power	kW	$0.12	
Process Treatment			
PACl	kg	$1.26	15 mg/L
Soda Ash	kg	$.076	60 mg/L
Chlorine Gas	kg		1.5 mg/L
Membrane Cleanings[1]			
Sodium Hypochlorite	L	$0.75	3,700 L/yr

Description	Units	Unit Cost	Quantities
Caustic Soda	kg	$1.02	600 kg/yr
Citric Acid	kg	$3.36	450 kg/yr
Sodium Bisulphite / Calcium Thiosulphate	kg	$2.06	1000 kg/yr
Hydrochloric Acid	kg	$0.97	200 kg/yr
Residuals Treatment			
PACl	kg	$1.26	5 mg/L

Notes:

1 – Quantities of membrane cleaning chemicals based on daily MWs and monthly CIPs for each train, and estimated quantities of chemical used per cleaning as provided by GE.

7.2.1 Equipment Replacement

An allowance of 0.5% of the initial mechanical and electrical capital costs is included. This allowance should fund capital equipment needs other than membrane replacement costs. For the membranes, it was assumed that 20% of the 5-year spare parts and cost list provided GE would represent one year's worth of replacement costs. This assumes a 10-year replacement cycle for membrane modules.

7.2.2 Maintenance and Repair

An allowance for mechanical and electrical maintenance costs has been estimate at 0.5% of the initial process and building mechanical capital costs. This allowance is to cover equipment maintenance and repair, including items such as maintenance contracts, lubricants, paint, laboratory supplies, and miscellaneous suppliers during the initial years of operation. It is expected that these maintenance and repair costs would increase as equipment ages. Annual building and grounds maintenance costs have been estimate at 0.2% of the structural costs to cover related building and grounds maintenance.

7.2.3 Electrical Power

Electric power consumption costs have been estimated based on the expected average annual electrical power demand based on the 5-year projected demand. Electrical demand has been estimate as follows:

- Membrane equipment: as provided by vendor
- Other process equipment: 55% of non-redundant connected load
- HVAC: 40% of connected load
- Lighting: 70% of connected load

7.3 COST ESTIMATES

Table 7-2 summarizes the estimated capital costs for the proposed Arbutus WTP Phase II project in 2017 dollars.

Table 7-2
Capital Cost Estimate

Item	Capital Cost
Construction Costs (by Division)	
Site Works	$1,600,000
Structural	
Concrete	$838,000
Masonry	$0
Metals	$1,357,000
Wood & Plastic	$60,000
Thermal & Moisture Protection	$43,000
Doors & Windows	$33,000
Finishes	$100,000
Specialties	$3,000
Special Construction	$12,000
Conveyance Systems	$0 (included in other divisions)
Furnishing	$15,000
Mechanical	
Equipment	$3,345,000
Process and Building Mechanical	$1,138,000
Electrical, Instrumentation and Controls	$888,000
Subtotal Division Costs	$9,436,000
Contractor Mobilization, Overhead and Profit (15%)	$1,415,000
Subtotal Construction Costs	**$10,851,000**
Project Contingency (15%)	$1,628,000
Subtotal Direct Costs	**$12,787,000**
Design and Engineering	$1,598,000
Escalation (2%)	$282,000
Escalated Project Cost (2019)	**$14,358,000**

A more detailed breakdown of the capital cost estimate is provided in Appendix G.

Annual operation and maintenance costs are provided in Table 7-3. The costs are based on the running the WTP at the 10-year ADD (69.5 L/s incoming, 66.2 L/s net of treated water).

Table 7-3

Operation and Maintenance Cost Estimate

Item	Annual Cost
Staffing	
Lead Operator ($56 / hour)	$117,000
Shift Operator ($56 / hour)	$117,000
Maintenance Staff ($56 / hour)	$117,000
Subtotal	$349,000
Power	$72,000
Chemical Use, Pre-treatment	
PACl	$41,000
Soda Ash	$100,000
Chlorine Gas	$5,000
Subtotal	$146,000
Chemical Use, Membrane Chemical Cleanings	
Sodium Hypochlorite	$3,000
Caustic Soda	$1,000
Citric Acid	$2,000
Sodium Bisulphite	$2,000
Hydrochloric Acid	$200
Subtotal	$7,000
Chemical Use, Residuals Treatment	
PACl	$1000
Equipment Replacement	
Membrane Replacement	$11,000
Miscellaneous Replacement	$5,000
Subtotal	$16,000
Maintenance and Repair	
Inside Building	$5,000
Building Exterior and Grounds	$5,000
Subtotal	$10,000
Total	**$601,000**

7.4 VALUE ENGINEERING

An Internal Value Engineering Session took place on September 25 to 26, 2017, with the following primary objectives:

- Reduce capital costs to meet the Town's target budget of $14 million.
- Provide a cost-effective design for a treatment facility that will be able to supply the projected 10-year design demand (125 L/s net) when built, with easy expansion for the 20-year design demand (156 L/s net).

The options discussed, and the recommended changes to the WTP design from the Value Engineering Session are detailed in Appendix H.

7.5 PROJECT SCHEDULE

Figure 7-1 shows the proposed project implementation schedule.

Certification Page

This report presents our findings regarding the Town of Ladysmith, Arbutus Water Treatment Plant Phase II.

Respectfully submitted,

Prepared by:

Reviewed by:

Keith Kohut, M.A.Sc., P.Eng.
Process Engineer

KK/lp

Appendix A – Preliminary Design Drawings

Appendix C - Buffer Tank Design Scenarios

Appendix D - Water Demand Projections

Appendix E - TM 1-1 Options Budgetary Analysis

Appendix F - Hydraulic Transient Analysis

Appendix G - Cost Estimate

Appendix H - Internal Value Engineering Session

STAFF REPORT TO COUNCIL

From: Angela Davies, Planner
Meeting Date: November 20, 2017
File No: 6800-20
RE: COMMUNITY HERITAGE REGISTER UPDATE

RECOMMENDATION:

That Council:

1. Approve the Statements of Significance for the following 10 heritage properties:

   i. Ladysmith Cemetery, 320 Christie Road
   ii. Nicholson House, 421 1st Avenue
   iii. Old Telephone Office, 422 Esplanade
   iv. 534 1st Avenue
   v. Bayview Apartment Building/Extension Hotel, 110 Esplanade
   vi. Ladysmith Arboretum, Transfer Beach Boulevard
   vii. Knight's Clock, 1st Avenue
   viii. Dragon City Restaurant Sign, 322 Esplanade
   ix. 341 1st Avenue
   x. Ladysmith City Hall, 410 Esplanade

2. Support the inclusion of the 10 properties to the Town's Community Heritage Register.

PURPOSE:

The purpose of this staff report is to present 10 Statements of Significance for heritage properties in Ladysmith and to request Council's support for the inclusion of 10 properties to the Town's Community Heritage Register.

PREVIOUS COUNCIL DIRECTION

Resolution	Meeting Date	Resolution Details
CS 2012-348	November 5, 2012	*It was moved, seconded and carried that the Town of Ladysmith Community Heritage Register be updated by adding all existing buildings listed in the Ladysmith Heritage Inventory.*

CS 2014-046	February 3, 2014	*That Council approve the Statements of Significance for the following 13 properties:* • *Comox Logging & Railway Shops Building (610 Oyster Bay Drive)* • *The Old Post Office (340 Esplanade)* • *Temperance Hotel (32 High Street)* • *Convent School (210 Buller Street)* • *Jones Hotel (12 Gatacre Street)* • *516 First Avenue Building (516 First Avenue)* • *Eagles Hall (921 First Avenue)* • *Coburn/Verchere House (641 Third Avenue)* • *Jessup's Drug Store (18 High Street)* • *Music Hall (18 Roberts Street)* • *Masonic Hall (26 Gatacre Street)* • *Johnson Shoes (528 First Avenue)* • *Ladysmith Railway Station* *And that these properties be added to the Community Heritage Register.*

INTRODUCTION/BACKGROUND:

In 2012, Council provided direction to update the Community Heritage Register (CHR) by adding all existing buildings listed in the Ladysmith Heritage Inventory. Since that time the Heritage Revitalization Advisory Commission (HRAC) reviewed properties using a ranking system to prioritize which properties should be recommended to be added during this current CHR update. 13 properties were added to the Community Heritage Register during the previous phased update in 2014. The current phase proposes the addition of 10 heritage buildings, sites and structures.

DISCUSSION:

The Community Heritage Register is an official list of heritage buildings, sites and structures identified by the Town as having heritage value or character. Ladysmith's CHR was created in 2006 and currently contains 22 records. Including properties on the CHR does not provide heritage protection, but rather identifies properties that are important to the Town due to their heritage value and character.

Inclusion on a Community Heritage Register can provide the following benefits:

- Buildings can take advantage of special equivalency provisions within the BC Building Code Heritage Building Supplement for heritage properties
- Ensures that property owners are aware of its heritage status
- Provision of information about the character-defining features of a property that should be considered when exterior changes to the building are planned
- Provides temporary protection measures through the Local Government Act for properties listed on the Community Heritage Register
- Eligibility for external funding when available

In addition, property owners can have a heritage plaque placed on the property to expand Ladysmith's interpretive history program.

The Local Government Act (section 598) specifies that in order to be included in the Community Heritage Register, there must be indications why the property is considered to have heritage value or heritage character. The preparation of a Statement of Significance (SOS) is the tool used to fulfill this requirement. SOS's include a property's description, heritage values, and character-defining elements. The Town's Heritage Strategic Plan (2008) advocates for the expansion of Ladysmith assets in the Community Heritage Register with ongoing preparation of Statements of Significance. The Town contracted with Christine Meutzner to research and prepare SOS's for the 10 properties, which are attached to this report.

SCOPE OF WORK:
The stage of this project is to seek Council approval for the 10 SOS's and Council's authorization to add the 10 properties to the CHR. If Council supports the recommendation, staff will proceed with the steps required under Local Government Act legislation including:

- Notice to the owner of the heritage property, and
- Notice to the heritage minister.

In addition, documentation will be sent to the Province for inclusion in the Provincial and National Register of Historic Places.

ALTERNATIVES:
Council can choose to not approve the SOS's and not support the inclusion of the 10 properties on the Community Heritage Register.

FINANCIAL IMPLICATIONS;
Funding for the continuation of this project is included in the current year of the Financial Plan.

LEGAL IMPLICATIONS;
The addition of properties to the CHR must be completed in accordance with Section 598 of the Local Government Act.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:
The Heritage Revitalization Advisory Commission reviewed the draft SOS's and provided comments and recommend that these properties be added to the CHR.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:
N/A

ALIGNMENT WITH SUSTAINABILITY VISIONING REPORT:
The Visioning report notes the importance of heritage properties as an element of a high quality public realm.

ALIGNMENT WITH STRATEGIC PRIORITIES:
Employment and tax diversity are Council strategic priorities.

SUMMARY:
The approval of the Statements of Significance and the addition of the 10 sites, structures and buildings to the Town's Community Heritage Register will provide official recognition of the heritage value and character of these properties and their importance to the Town of Ladysmith.

Angela Davies, Planner — November 14, 2017 Date Signed

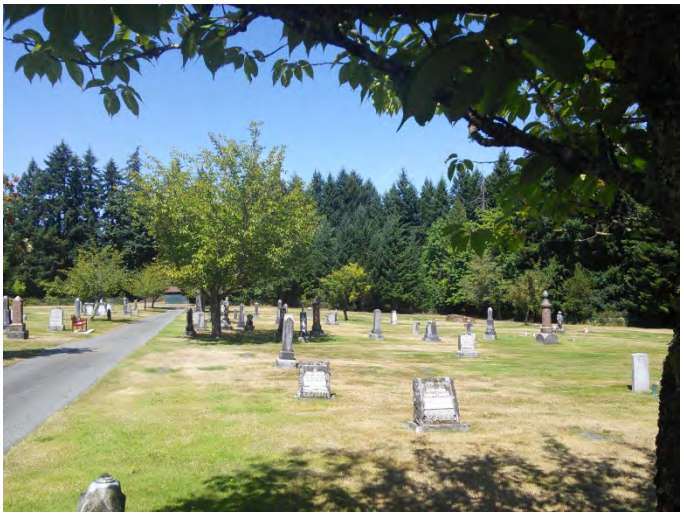
Reviewed By

Felicity Adams, Director of Development Services — November 14, 2017 Date Signed

I concur with the recommendation.

Guillermo Ferrero, City Manager

ATTACHMENTS:
Ladysmith Statements of Significance (Christine Meutzner)



LADYSMITH CEMETERY
320 CHRISTIE ROAD

DESCRIPTION OF THE HISTORIC PLACE

The Ladysmith Cemetery is located on the northern edge of the community. The historic place is confined to the legal boundaries of the cemetery.

HERITAGE VALUE

Established in 1904, the Ladysmith Cemetery is a tangible link with the community's social, cultural and economic history. The original division of the cemetery into quadrants by religious denomination provides evidence of the importance of those categories as markers of social identification in the young community. Over time, religion became less important as a social distinction and people of all denominations were buried in all quadrants. In addition, the headstones provide evidence of the community's population composition. Unlike nearby Nanaimo, which was developed predominantly by English and Scottish settlers, the headstones at Ladysmith Cemetery indicate an ethnically diverse population that included significant numbers of Italians, Finns, Belgians and other ethnic groups. Most poignantly, many headstones tell of deaths due to mining accidents, a common occurrence in Ladysmith history. As a whole, the cemetery functions as a fully accessible outdoor classroom of Ladysmith history.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Ladysmith Cemetery are:

- all the elements within the legal boundaries of the Ladysmith Cemetery including the mature plantings and pathway inlaid brass markers that indicate the original religious quadrants
- all of the historic headstones that reflect Ladysmith's early ethnic diversity and mining history

NICHOLSON HOUSE
421 FIRST AVENUE

DESCRIPTION OF THE HISTORIC PLACE

The Nicholson House is a small, false-fronted building on the east side of the main commercial street in Ladysmith, British Columbia. The historic place is confined to the building footprint.

HERITAGE VALUE

Built around 1901, the Nicholson House is significant for its association with early developer and community leader Donald Nicholson. Nicholson was a member of the first town council and served as Mayor in 1906 and 1908-1909. In addition to this building, Nicholson built Ladysmith's first hospital, its first purpose-built school, the Opera House and several other early buildings. A section of road in nearby Cedar, still known as the Speedway, was graded and built by Nicholson, originally for use as a horse racing track.

The Nicholson Building is also significant for its association with Jack Keno who operated a barbershop at this location for 45 years. In the 1920s, Keno converted the Nicholson House to commercial premises by adding a false front and extending the building to the front property line.

The Nicholson House is a good example of a modest, vernacular commercial building. It is one of several similar buildings in Ladysmith's commercial core and is an important component of a large group of historical buildings.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Nicholson House include:

- all of the elements of its vernacular Boomtown architecture as expressed in the wood siding, Boomtown false-front façade and simple door and window arrangement
- the building's location within a group of historic buildings on the town's main commercial street
- the building's small scale, simple form and massing

OLD TELEPHONE OFFICE BUILDING
422 ESPLANADE

DESCRIPTION OF THE HISTORIC PLACE

The Old Telephone Office Building is a small, vernacular, Boomtown style building located on the main highway through Ladysmith, British Columba. The historic place is confined to the building footprint.

HERITAGE VALUE

The Old Telephone Office Building has housed numerous commercial ventures over the years but it is most significant as the long-time location of the local telephone exchange, a key community service.

Built around 1903, the Old Telephone Office Building is a very good example of a vernacular Boomtown or false-front style structure. Until the construction of more sophisticated brick buildings over the next few decades, Ladysmith's first commercial buildings were typically wood framed and clad, and false-fronted. Boomtown fronts made buildings appear more substantial and provided a convenient space for signage. The building has had many renovations over the years, but its basic form and scale remain intact.

As the only remaining building of its type in this part of Ladysmith and because of its location on the main highway, the Old Telephone Office building is a significant landmark.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Old Telephone Office Building include:

- all of the elements of its vernacular Boomtown architecture as expressed in the wood siding, Boomtown false-front facade, and simple single door and large window arrangement
- the building's small scale, simple form and massing
- the building's location on the main highway
- the building's continuous commercial use for over a century

534 FIRST AVENUE BUILDING
534 FIRST AVENUE

DESCRIPTION OF THE HISTORIC PLACE

The 534 First Avenue Building is a modest, two-storey commercial building on the west side of the main commercial street in Ladysmith, British Columbia. The historic place is confined to the building footprint.

HERITAGE VALUE

The 534 First Avenue Building's primary significance is as part of a grouping of largely intact historic buildings in Ladysmith's commercial core. Situated at the northern end of the main commercial thoroughfare, the building forms part of an almost continuous city block of similarly proportioned historic buildings that collectively create a cohesive streetscape.

Built around 1904, the 534 First Avenue Building has been substantially renovated and many of its original features changed or obscured. The building's simple form, two-storey height, Boomtown-style false-front and entrance level door and window arrangement are intact and are in keeping with the rest of the buildings on this city block.

Associated with Ladysmith's earliest development, the 534 First Avenue Building has been in continuous commercial use for over a century and is a major contributor to the street's heritage character.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the 534 First Avenue Building include:

- the building's location within a large grouping of heritage buildings on the main commercial street
- the building's simple form and two-storey height
- the building's false front
- the large windows and inset doors at the street level
- the building's continuous commercial use for over a century

BAYVIEW APARTMENT BUILDING
EXTENSION HOTEL
BAYVIEW HOTEL
110 ESPLANADE

DESCRIPTION OF THE HISTORIC PLACE

The Bayview Apartment Building is a brick, three-storey Edwardian structure located on the main highway through Ladysmith, just outside the downtown core. The historic place is confined to the building footprint.

HERITAGE VALUE

The Bayview Apartment Building is significant as a tangible reminder of the social and economic importance of hotels in Ladysmith history. Like most mining communities, early Ladysmith had a large population of single, often transient, men. As affordable housing alternatives, hotels functioned as living quarters and, in the saloons and restaurants typically located on the ground floor, as social centres.

Originally built around 1904 and substantially redeveloped around 1910, the Bayview Apartment Building is a very good example of Edwardian Commercial style. The building features the simplicity and overall restrained appearance typical of this style and stands in marked contrast to earlier, fussier Victorian styles.

The Bayview Apartment Building exemplifies the nature of Ladysmith's earliest social and physical development. Like many other buildings in Ladysmith, this structure was moved from Extension (many more were moved from Wellington) around 1904. In effect, Ladysmith was an instant company town. The early presence of these relocated buildings gave the young town a sense of permanence, cohesion and civility not often associated with pioneer mining towns.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Bayview Apartment Building include:

- all of the elements of an Edwardian era commercial building as expressed in the overall restrained appearance, simple form and massing, symmetrical façades, flat roof, brick construction on upper stories, quoined corners, articulated brick pattern below cornice arched window lintels and simple cornice.
- the building’s location on the main highway

LADYSMITH ARBORETUM
TRANSFER BEACH BOULEVARD

DESCRIPTION OF THE HISTORIC PLACE

The Ladysmith Arboretum, which contains a variety of native and exotic tree species and open space, is a municipal park located at the intersection of Transfer Beach Boulevard and the Trans-Canada Highway in Ladysmith, British Columbia. The historic place is confined to the legal boundaries of the park.

HERITAGE VALUE

The Arboretum is significant for its association with the Comox Logging and Railway Company, which played the key role in the resuscitation of the town's economy after the coal mines closed in 1931. For several years, Ladysmith suffered a severe economic slump and the town experienced a loss in population. This situation was dramatically reversed in 1936 when the Comox Logging and Railway Company started a major new logging initiative in the area. The Arboretum was developed by the company in 1947-8 and is a reminder of its pivotal role as Ladysmith's economic saviour.

The Ladysmith Arboretum is also significant for its association with Frederick D. Mulholland, who was responsible for its creation. Mulholland was the forest company's Chief Forester and is known as "The Father of Sustained Yield Forestry in British Columbia." Mulholland worked for the B.C. Forest Service for nearly two decades. He designed many of the forest survey field procedures used during the 1920s and 1930s and in 1937 Mulholland compiled the first provincial inventory of B.C.'s forest resources. A staunch advocate of sustained yield forest management, he was also prominent in the Canadian Society of Forest Engineers (later the Canadian Institute of Forestry) and founded the Association of B.C. Forest Professionals in 1947, becoming its first President.

As an accessible, outdoor museum of local and exotic plant life, the Ladysmith Arboretum has considerable environmental value. Although many of the original trees have been removed for safety or road widening reasons, enough remain for public education and appreciation.

The Ladysmith Arboretum's social value lies in its on-going use as an easily accessible community park and as a green oasis flanking a very busy highway.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Ladysmith Arboretum include:

- all of the trees, both original and newly-planted, located within park boundaries
- any paths and other features that ensure the park is easily accessible
- any plaques or other features that ensure the park retains its educational value.

KNIGHT'S CLOCK
FIRST AVENUE

DESCRIPTION OF THE HISTORIC PLACE

Knight's Clock is a free-standing neon sign and clock located on the main commercial street in Ladysmith, British Columbia. The historic place is restricted to the sign-clock.

HERITAGE VALUE

Knight's Clock is significant for its association with the Knight Collection of artifacts and archives. For over 100 years, members of the Knight family, and especially Ray Knight, collected materials related to Ladysmith and area history. This substantial collection was eventually purchased by the Town of Ladysmith and forms the core of the Ladysmith Historical Society's museum and archives' collections.

Originally mounted on the building around 1947, Knight's Clock is significant as the only tangible evidence of Knight's Store, which existed near this site from 1904 until it burned down in 1981. For almost 80 years, Knight's Store served local residents and the clock subsequently has substantial symbolic value for those who once worked and shopped there.
The clock's height and position on the main commercial street make it a prominent local landmark.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of Knight's Clock include:

- its location adjacent to the original store site on the main commercial street
- all of the original elements of the sign and clock.

DRAGON CITY RESTAURANT SIGN
322 ESPLANADE

DESCRIPTION OF THE HISTORIC PLACE

The Dragon City Restaurant sign is a freestanding neon sign sited in front of the original restaurant building and located on the main highway through Ladysmith, British Columbia.

HERITAGE VALUE

Installed at this site around 1967, the Dragon City Restaurant sign is significant as a rare, surviving example of the type of commercial signage that was popular in Ladysmith until the mid-1970s. The sign's style speaks to a specific era and to a specific commercial aesthetic. Although the lettering has changed to reflect the restaurant's name change, the stylized pagoda shape of the sign is original.

The Dragon City Restaurant sign is a direct link to the important social and economic role the Chinese have played in Ladysmith's history. Initially employed as mine and wharf labourers, the Chinese eventually worked in other occupations and continued to add to the economic and social fabric of the community. Chinese restaurants like Dragon City offered many local residents their first experience of foreign or ethnic food and thus played an important role in the cultural development of the community.

Typical of its era, the large, highly visible neon sign was a practical response to the speed of passing cars, enticing customers with its bold shape and colours. Unlike most signs of its type, the Dragon City sign has survived in connection with its original business.

The prominent Dragon City sign, located on a very busy thoroughfare, is an important landmark to both residents and visitors.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of the Dragon City Neon Sign include:

- the scale of the sign and its stylized pagoda shape and period colours
- the sign's location on the main highway through Ladysmith

341 FIRST AVENUE BUILDING
341 FIRST AVENUE

DESCRIPTION OF THE HISTORIC PLACE

341 First Avenue is a modest, two-storey, brick, Edwardian commercial structure on the east side of Ladysmith's main commercial street. The historic place is confined to the building footprint.

HERITAGE VALUE

Built around 1910, 341 First Avenue is a good example of a modest, Edwardian style commercial building. The building's symmetrical façade, pilasters, and brick construction are all typical elements of this style. The original elaborate cornice has been removed but the overall form and general appearance remain intact.

This landmark building marks the southern end of a grouping of largely intact historic buildings in Ladysmith's commercial core. This grouping creates a significant block of similarly proportioned historic buildings that collectively create a cohesive streetscape.

341 First Avenue has been in use as a commercial building since its construction and its tenants continue to provide a range of goods and services to the community.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of 341 First Avenue include:

- all of the elements of a modest Edwardian era commercial building including its overall restrained appearance, simple form and massing, symmetrical, two-bay façade, flat roof, brick construction with modest pilasters and the arrangement of the storefront doors and windows including the centred upstairs access door.
- the building's landmark function as the southern end of a group of similarly proportioned historic commercial buildings on the town's main commercial street
- the building's continuous commercial use

LADYSMITH TOWN HALL
LADYSMITH CITY HALL
410 ESPLANADE

DESCRIPTION OF THE HISTORIC PLACE

Ladysmith Town Hall is a one-storey, International style building located at an intersection of the main highway that runs through Ladysmith, British Columbia. The historic place is confined to the building footprint.

HERITAGE VALUE

From 1917 to the opening of this building in 1952, civic business was conducted from a converted hotel on this site. The purpose-built Town Hall represents the maturation and modernization of the municipal government and, by extension, the City as a whole.

Built in 1951-52, Town Hall is an excellent, early example of the International style in Ladysmith. New and fresh, the style was appropriate for a municipality trying to project progress and modernity in the post-war boom years. The building is substantially intact.

Ladysmith Town Hall is significant for of its association with architect Thomas B. McArravy. One of the pioneers of the use of modernism on Vancouver Island, McArravy was a prominent architect for many years. His known credits include Nanaimo City Hall, Nanaimo Library (Fitzwilliam Street, Nanaimo) and Tom Brown Auto Body (Front Street, Nanaimo). Ladysmith Town Hall has survived in near pristine condition, a testament to the integrity of the original design and McArravy's skill.

The building is a highly visible landmark on a busy highway.

CHARACTER-DEFINING ELEMENTS

The character-defining elements of Ladysmith town hall include:

- all of the elements of a modest International style building including the clean horizontal form and plain detailing, concrete construction, flat roof, symmetrical façade with two projecting bays and inset entrances at both corners, abundant windows and louvered detailing below front central windows
- the building’s location on a major highway

STAFF REPORT TO COUNCIL

From: Felicity Adams, Director of Development Services
Meeting Date: November 20, 2017
File No: 3760-03
RE: FIRE SPRINKLERS AND FIRE SPRINKLER SYSTEMS – Bylaw 1940

RECOMMENDATION:

That Council give first, second and third reading of Bylaw 1940, cited as "Town of Ladysmith Building Fire Sprinkler System Bylaw 2017, No. 1940" under the Bylaws portion of tonight's agenda.

PURPOSE:

The purpose of this staff report is to present a bylaw that would have the effect of maintaining the Town's current requirement for fire sprinklers and fire sprinkler systems in buildings in the downtown in certain circumstances beyond the requirements of the BC Building Code.

PREVIOUS COUNCIL DIRECTION:

FireSprinkler Bylaw	95-0411	07/10/95	Staff to prepare (or amend Bldg. Bylaw) by Aug. 15
Bylaw #1178	95-0564	09/05/95	Steve Szentveri permitted to address Council
Bylaw #1178	95-0565	09/05/95	Building and Plumbing Bylaw introduced, read 1st & 2nd time
Bylaw #1178	95-0598	09/18/95	Building and Plumbing Bylaw read a third time
Bylaw #1178	95-0621	10/02/95	Building and Plumbing Bylaw adopted.

Updating the Town's Building Bylaw given the new provincial *Building Act* is a Council strategic priority.

INTRODUCTION/BACKGROUND:

The Province has enacted the *Building Act* which has the effect of standardizing building regulations across the Province, except in Vancouver which has its own Building Code.

As a result of this legislation, a local building requirement has no effect unless prescribed by regulation as an unrestricted matter. The Building Act General Regulation provides local authority jurisdiction over unrestricted matters (e.g. energy conservation) and certain time-limited unrestricted matters (e.g. fire sprinklers) which can be enacted up until December 15, 2017. The Town's Building and Plumbing Bylaw No. 1119 is subject to review and amendment as a current Council project. As a first step, it was reviewed to determine if there are any "time-limited" matters that need to be considered by Council prior to the December 15, 2017 date.

One such item has been identified which is the local requirement for fire sprinklers and fire sprinkler systems to be installed in certain circumstances within the downtown (regulation 6.2.2.8). In order to maintain this requirement, if Council wishes to do so, it is recommended that this section be established in a stand-alone bylaw prior to December 15th so that it is retained when the parent Bylaw 1119 is updated and potentially replaced by a new bylaw. After December 15th amendments to these time-limited restricted matters is not possible.

Staff has been advised that the Province still anticipates enacting an opt-in regulation with higher-than-Code requirements for fire sprinklers. Local authorities will have the option of signing onto the regulation. It is expected that it will be some time before the opt-in regulation is rolled out.

Bylaw 1940

Proposed Bylaw 1940 presented in this staff report does not change the current bylaw requirements. The amendment is to ensure that we meet the legislative timeline and ensure the retention of this requirement if Council wishes to do so.

The original requirement was enacted in October 1995. In March 2003, Council amended the Bylaw so that the requirement was limited to buildings in the Downtown. It is the understanding of staff that the policy basis for this requirement was to provide the potential for the protection of the heritage buildings in the downtown through the installation of fire sprinklers when building upgrades of a certain value were being done and when the Building Code would not otherwise require this improvement.

While there has been little take-up of this requirement over the past 20-years when buildings are being renovated, there have been other building improvements to buildings in the downtown that have resulted in enhanced fire separation within and between buildings. Three new buildings in the downtown were sprinklered as a result of this requirement.

Currently , the 2012 BC Building Code regulates when a building is required to have a fire protection sprinkler system, e.g. occupancy type, occupant load, building size, building height and type of construction. This Bylaw does not affect this requirement, but rather sets conditions where a fire sprinkler system may be required as a local building regulation, despite not being a requirement of the Building Code. A three-storey building

with an assembly occupancy (e.g. restaurant) with mixed occupancy above (e.g. Traveller's Hotel) would be subject to the sprinkler requirements of the Building Code. There are some limited Code equivalencies available to sprinklered buildings on the Community Heritage Register.

Next Phase

The next stage of the Building Bylaw project will involve a review of the model building bylaw currently under preparation by the Municipal Insurance Association (MIA) and other recent local government bylaws for best practices. The model MIA building bylaw is expected to be available before the end of the year. As part of this review, staff will be looking at the bylaw requirements to determine which regulations are out-of-date and could be removed or should be clarified, as well as where there might be gaps. Through this process, staff intends to streamline the application and inspection process by clarifying the steps in the process and related requirements. The current Bylaw No. 1119 was enacted in 1994 and it has been amended 17 times.

ALTERNATIVES:

Council can choose to remove the fire sprinkler and fire sprinkler system requirements. If Council choses to do so, there would be no need to take any action with respect to Bylaw 1940 at this time, as the current requirement would cease to have any affect after December 15th.

FINANCIAL IMPLICATIONS;

None.

LEGAL IMPLICATIONS;

Staff consulted with legal services to determine what changes, if any, would be needed to meet the requirements of the *Building Act* and General Regulation.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:

No substantive changes have been proposed to the Bylaw which is proposed in order to meet the legislative timeline. If Council was to decide to no longer include this regulation there could be varied opinion of property owners and the general public.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The Fire Chief recommends that Council keep the fire sprinkler bylaw because of the density (close proximity) of buildings in the downtown area. Adding fire prevention within the buildings in the downtown is important due to the residential occupancy above the commercial units and for limiting fire spread between buildings. Fire sprinklers protect the building by knocking down the fire and containing it. The 3-year threshold should be changed to catch more buildings when renovations are being done. The buildings that have been sprinklered as a result of this requirement include new builds only (132 Roberts Street, 16 High Street and 11 Buller Street); no building renovations have been captured.

ALIGNMENT WITH SUSTAINABILITY VISIONING REPORT:

☒Complete Community Land Use
☐Green Buildings
☐Innovative Infrastructure
☐Healthy Community
☐ Not Applicable
☐ Low Impact Transportation
☐ Multi-Use Landscapes
☐ Local Food Systems
☐ Local, Diverse Economy

ALIGNMENT WITH STRATEGIC PRIORITIES:

☐Employment & Tax Diversity
☐Watershed Protection & Water Management
☐Communications & Engagement
☐ Natural & Built Infrastructure
☐ Partnerships
☒ Not Applicable

SUMMARY:

The enactment of the provincial Building Act General Regulation provides a window for Council to enact certain matters that are outside of the Building Code. One such matter in the Town's Building Bylaw is fire sprinklers and fire sprinkler systems in the downtown. Staff recommends that if Council wishes to maintain this requirement, Bylaw 1940 be adopted by December 15, 2017. The provision could stay in the current bylaw; however, when this bylaw is amended, staff does not want to inadvertently affect this requirement if Council wishes to retain it.

November 14, 2017

Felicity Adams, Director of Development Services

I concur with the recommendation.

Guillermo Ferrero, City Manager

ATTACHMENTS:

Bylaw 1940

TOWN OF LADYSMITH

BYLAW NO. 1940

A bylaw to establish a local building requirement for Fire Sprinkler and Fire Sprinkler Systems

WHEREAS the Council of the Town of Ladysmith wishes to maintain a local building requirement for the installation of fire sprinklers and fire sprinkler systems pursuant to the Building Act General Regulation (BC Reg. 131/2016);

NOW THEREFORE the Council of the Town of Ladysmith, in open meeting assembled, hereby enacts as follows:

Definitions

1. In this Bylaw, unless the context otherwise requires, the following words have the following meanings:

   "**Applicant**" means either the owner of a parcel or a person authorized in writing by the owner to apply for and obtain a *Building Permit*;

   "**Building**" means any structure used or intended for supporting or sheltering any use or occupancy except those prescribed by regulation as exempted from the *Building Code*;

   "**Building Code**" means the Code as defined in the Buildings and Other Structures Bylaws Regulation, BC Reg. 86/2004;

   "**Building Bylaw**" means the Town of Ladysmith "Building and Plumbing Bylaw 1994, No. 1119" as amended or replaced from time to time;

   "**Building Inspector**" means the building inspector of the *Municipality* from time to time;

   "**Construction value**" means the value of construction provided by the applicant or a construction valuation calculation accepted as an equivalent by the Building Inspector;

   "**Municipality**" means the Town of Ladysmith;

   "**Permit**" means a *Permit* issued by the *Building Inspector* for the construction or alteration of a building, or the installation, alteration or replacement of plumbing pursuant to the *Building Bylaw;*

   "**Professional Engineer**" means a person who is registered or licenced as a professional engineer under the Engineers and Geoscientists Act [RSBC 1996], c. 116.

Fire Sprinklers and Fire Sprinkler Systems

2.1 A person who constructs or causes to be constructed a *Building* within that part of the *Municipality* shown in heavy outline on Schedule A to this Bylaw must, as part of the construction of the *Building*, install an automatic sprinkler system throughout the entire building.

1.2 No *Permit* will be issued for a *Building* to which section 2.1 applies unless the applicant for the *Permit* has submitted a design drawing from a *Professional Engineer* in accordance with the *Building Code* showing the location of the fire sprinklers and associated water lines.

2.3 The automatic sprinkler system required under section 2.1 shall be installed in accordance with the *Building Code*.

2.4 The automatic sprinkler system required under section 2.1 shall be maintained in

accordance with the *Building Code* and the requirements of the National Fire Protection Association (NFPA) "Inspection, Testing and Maintenance of Water-Based Fire Protection Systems."

2.5 Section 2.1 does not apply where the construction will result in any of the following:

2.5.1 the creation and/or location of no more than a single residential unit on the parcel;

2.5.2 the construction of a detached *Building* having a total gross floor area of less than 100 square metres (1076.4 square feet);

2.5.3 an addition to an existing *Building* that will not exceed the lesser of 25% of the existing floor area of the *Building* or a maximum gross floor area of 200 square metres (2152.8 square feet);

2.5.4 the construction of an unoccupied mechanical *Building* having a floor area not exceeding 300 square metres (3,229.2 square feet) or a non-combustible *Building* used only for a car wash having a floor area which does not exceed 300 square metres (3,229.2 square feet);

2.5.5 the creation of non-combustible canopies over gasoline pumps or other areas where flammable liquids are handled;

2.5.6 an application for a *Permit* for only plumbing fixtures and/or plumbing reconfiguration; or

2.5.7 the alteration of an existing *Building* where the *Construction Value* will not exceed 50% of the assessed value of the *Building* as determined by the B.C. Assessment Authority in the assessment immediately preceding the *Permit* application.

2.6 For the purposes of section 2.5.7, any construction of or to a *Building* shall be deemed to include construction for which a *Permit* was issued within the thirty-six (36) months immediately preceding the application for a *Permit*.

Administrative Remedies

3.1 A Building Inspector may order the cessation of any work that is proceeding in contravention of the *Building Code* or this Bylaw, by posting a "Stop Work Order" on the parcel on which such work is undertaken.

3.2 An owner of property on which a "Stop Work Order" has been posted shall cease or cause the cessation of all further work on the *building* immediately and shall not do any work until all provisions of the *Building Code*, this Bylaw and the *Building Bylaw* have been fully complied with.

Repeal

4. "Building and Plumbing Bylaw 1994, No. 1119, Amendment Bylaw 1995, No. 1178" is hereby repealed.

Penalties and Enforcement

5.1 A person who violates a provision of this Bylaw is liable on summary conviction to a maximum penalty of Ten Thousand Dollars ($10,000) and costs.

5.2 Each day that a violation occurs or is permitted to continue constitutes a separate offence.

Severability

6. If any section of this Bylaw is held invalid by a court, the invalid portion shall be severed from this Bylaw without affecting the validity of the remainder of the Bylaw.

Citation

7. This Bylaw may be cited for all purposes as the "Town of Ladysmith Building Fire Sprinkler System Bylaw 2017, No. 1940."

READ A FIRST TIME	**on the**	**day of**	,
READ A SECOND TIME	**on the**	**day of**	,
READ A THIRD TIME	**on the**	**day of**	,
ADOPTED	**on the**	**day of**	,

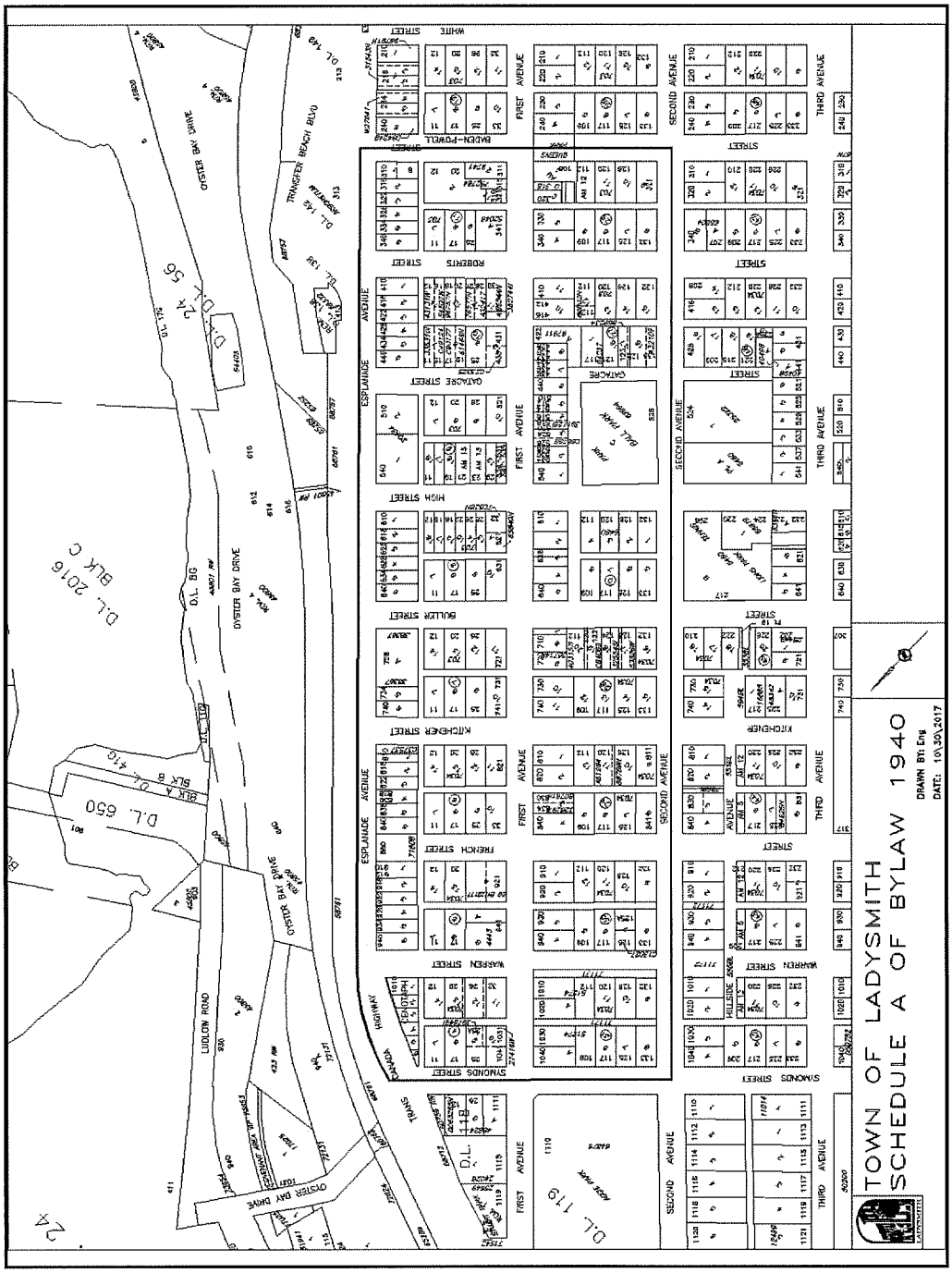
_____
Mayor (A. Stone)

_____
Corporate Officer (J. Winter)

Schedule "A"

TOWN OF LADYSMITH

Building Sprinkler System Bylaw 2017



November 21, 2017 File: 0400-40 PM

Via Email: PM@pm.gc.ca

The Right Honourable Justin P.J. Trudeau, PC, MP
Prime Minister of Canada
80 Wellington Street
Ottawa, ON K1A 0A2

Dear Prime Minister:

Re: Abandoned Vessels Legislation C-352 – Request for Debate in the House of Commons

On behalf of the Town of Ladysmith Council, I am writing to request that you vote to allow MP Sheila Malcolmson's legislation C-352 on abandoned vessels to be debated in the House of Commons. Council strongly disagrees with the Liberals' November 9 decision to use their majority at the Standing Committee on Procedure and House Affairs to deem C-352 non-votable.

For too long, jurisdictional gaps have left coastal communities with nowhere to turn when they need help cleaning up abandoned vessels. Oil spills and marine debris from thousands of abandoned vessels pollute our waterways and put local fishing and tourism jobs at risk.

MP Malcolmson's bill C-352 is built on years of advice from coastal communities to fix vessel registration, pilot a vessel turn-in program, create good green jobs by supporting local marine salvage businesses and vessel recycling, and end the jurisdictional runaround by making the Coast Guard responsible for directing the removal of abandoned vessels.

Council also supports your government's new Bill C-64 on abandoned vessels, introduced October 30 and appreciates that the Federal Government recognizes the gravity of this issue. However, Bill C-64 does not include any of the solutions listed above, and doesn't deal with the massive backlog of abandoned vessels plaguing coastal communities. In our own Ladysmith Harbour, we have seen two derelict vessels sink in the last two weeks. Each poses the potential for major spills and contamination, and we fear that other derelict vessels will join them if the issue is not fully addressed.

Bills C-64 and C-352 complement each other, and it makes far greater economic and environmental sense that they both receive full airing and debate in the House.

On behalf of our citizens, Stz'uminus First Nation neighbours and all those who earn a living in and around Ladysmith Harbour, I urge you to heed the united call from coastal and interior communities across Canada, and vote to allow C-352 to be debated in the House of Commons.

Sincerely,

Aaron Stone
Mayor

C: Ms. Sheila Malcolmson, MP, Nanaimo-Ladysmith
(via email: Sheila.Malcolmson@parl.gc.ca)
The Honourable Marc Garneau, Minister of Transport
(via email: Marc.Garneau@parl.gc.ca)
The Honourable Dominic LeBlanc, Minister of Fisheries, Oceans and the Canadian Coast Guard
(via email: Dominic.Leblanc@parl.gc.ca)

Town of Ladysmith

STAFF REPORT TO COUNCIL

From: Joanna Winter, Corporate Officer
Date: November 20, 2017
File No: 5600-01
RE: ALTERNATIVE APPROVAL PROCESS OFFICIAL RESULT -- NEW FIRE/RESCUE APPARATUS

RECOMMENDATION:

That Council:

1. Receive the official results of the Alternative Approval Process for borrowing funds to purchase a new Fire/Rescue apparatus;
2. Direct staff to award the contract for the purchase of a new Ladysmith Fire/Rescue Apparatus to Fort Garry Fire Trucks in the amount of $637,581 plus applicable taxes as elector approval of the borrowing has been received; and
3. Direct staff to apply to finance the new Ladysmith Fire/Rescue Apparatus through the Equipment Financing Program of the Municipal Finance Authority.

PURPOSE:

The purpose of this report is to provide Council with the official results of the recently-conducted Alternative Approval Process to borrow funds to acquire a new Fire/Rescue Apparatus, and to seek approval to proceed with purchasing the apparatus through the Municipal Finance Authority.

PREVIOUS COUNCIL DIRECTION

Resolution	Meeting Date	Resolution Details
CS 2017-266	Aug-21-2017	That Council: 1. Rescind resolution CS 2017-202; 2. Confirm its intent to seek elector approval by Alternative Approval Process to borrow funds to acquire a new Fire/Rescue Apparatus; 3. Upon the receipt of elector approval, direct staff to award the contract for the purchase of a new Ladysmith Fire/Rescue Apparatus to Fort Garry Fire Trucks in the amount of $637,581.00 plus applicable taxes. 4. Direct staff to amend the 2017 to 2021 Financial Plan to update the purchase price of the new Fire/Rescue Apparatus.

INTRODUCTION/BACKGROUND:
An Alternative Approval Process for elector approval to borrow up to $638,000 plus applicable taxes to purchase a new Fire/Rescue Apparatus was carried out in accordance with the legislation. The Town received no (0) elector response forms opposing the proposed borrowing. The total number of voters for the purposes of this Alternative Approval Process was 8,988. The number of Elector Response Forms required to ensure the borrowing did not receive elector approval was 899. The proposed borrowing has therefore received the approval of the electors and Council may now direct staff to proceed to borrow the funds.

The vehicle to be purchased is a Pumper Apparatus consisting of a 2018 Spartan Metro Star six person cab and chassis with formed aluminum body, 450 HP Cummins diesel engine, 3000 EVS Allison transmission, 1500 GPM fire pump, 1000 gallon water tank. This vehicle will be built by Fort Garry Fire Trucks in Winnipeg, Manitoba. This vehicle will be replacing the 1990 Pierce Fire Apparatus.

The estimated yearly payment is $34,520 The term of the loan will be up to 25 years.

A Fire Vehicle Plan is in place to ensure that there is funding set aside in a reserve account to replace Ladysmith Fire/Rescue equipment as the assets reach the end of their useful life. The funds set aside are to equal the replacement cost divided by the life of the asset. Council included up to $635,000.00 in the 2017 to 2021 Financial Plan for the purchase of a new Ladysmith Fire/Rescue Apparatus to replace the aging Ladysmith Fire/Rescue 1990 Pierce Apparatus.

In accordance with the Town's Purchasing Policy, staff issued a Request for Proposals (RFP) regarding the acquisition of the new Ladysmith Fire/Rescue vehicle. Three proposals were received and after a review by the Ladysmith Fire/Rescue committee of the bids submitted, staff and the committee recommend accepting the low bid in the amount of $637,581.00 plus taxes.

ALTERNATIVES:
N/A

FINANCIAL IMPLICATIONS;
Now that voter approval has been received, the Town can apply to the New Equipment Financing Program of the Municipal Finance Authority to finance the new fire truck.

LEGAL IMPLICATIONS;
The Alternative Approval Process was conducted in accordance with the provincial legislation.

CITIZEN/PUBLIC RELATIONS IMPLICATIONS:
The Alternative Approval Process is an opportunity for citizens to indicate whether or not they approve of the proposed borrowing.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The Financial Services Department will manage the borrowing process and support Ladysmith Fire/Rescue in the purchase of the new fire truck.

ALIGNMENT WITH SUSTAINABILITY VISIONING REPORT:

☐Complete Community Land Use
☐Green Buildings
☐Innovative Infrastructure
☒Healthy Community
☐ Not Applicable
☐ Low Impact Transportation
☐ Multi-Use Landscapes
☐ Local Food Systems
☐ Local, Diverse Economy

ALIGNMENT WITH STRATEGIC PRIORITIES:

☐Employment & Tax Diversity
☐Watershed Protection & Water Management
☐Communications & Engagement
☐ Natural & Built Infrastructure
☐ Partnerships
☒ Not Applicable

SUMMARY:

An Alternative Approval Process for elector approval to borrow funds for the purchase of a new Fire/Rescue Apparatus has been carried out in accordance with the legislation. The Town received no elector response forms indicating opposition to the proposed borrowing. The total number of voters for the purposes of this Alternative Approval Process was 8,988. The number of Elector Response Forms required to ensure the borrowing did not receive elector approval was 899. The borrowing has therefore received the approval of the electors. And it is recommended that council direct staff to borrow the funds needed to purchase the new fire truck.

Joanna Winter, Corporate Officer

November 9, 2017

I concur with the recommendation.

Guillermo Ferrero, City Manager