Comox Valley REGIONAL DISTRICT

Staff Report

DATE: September 9, 2020

FILE: 5340-04

TO: Chair and Directors
Electoral Areas Services Committee

FROM: Russell Dyson
Chief Administrative Officer

Supported by Russell Dyson
Chief Administrative Officer

R. Dyson

RE: **Hornby Island – Composting Toilets Study**

Purpose

This report presents the results of a feasibility study for management of composting toilets residuals on Hornby Island.

Recommendations from the Chief Administrative Officer:

1. THAT the option of collecting composting toilet residuals at the Hornby Island Waste Management Centre for transport to and processing at the Comox Valley Sewerage Service's biosolids composting facility be further investigated, including the following:
    a. Present study results to Hornby Island Residents' and Ratepayers' Association to discuss operational impacts at the Hornby Island Waste Management Centre;
    b. Confirm if central collection and transport can fit within scope of existing 360 function;
    c. Confirm appropriate land-use with Islands Trust;
    d. Seek approval from the Comox Valley Sewerage Service for processing residuals at biosolids composting facility in Cumberland; and
    e. Present study results to Hornby Island community.

    AND FURTHER THAT a follow up report on the results of this further investigation be brought to the Electoral Areas Services Committee in early 2021, with a recommendation on whether to proceed or not proceed with implementation.

2. THAT composting toilet residuals management information be developed for inclusion in the Comox Valley Regional District's septic education program, targeted to residents on Hornby and Denman islands, and other areas where composting toilet usage is identified.

Executive Summary

The July 2016 release of the BC Ministry of Health's Provincial Manual of Composting Toilet and Greywater Practice introduced guidelines for the use of composting toilets in BC, including standards for management of composting toilet residuals. These new requirements make on-property discharge of these residuals more challenging for homeowners with composting toilets.

- Ed Hoeppner, a Hornby Island based Registered Onsite Wastewater Practitioner (ROWP), sought support from the Comox Valley Regional District (CVRD) for a feasibility study for an on-island processing facility for composting toilet residuals.
- The CVRD hired a team lead by Ian Ralston, one of the authors of the Manual, to complete a feasibility study for composting toilet residuals management on Hornby Island.
- The study investigated the feasibility of constructing a small composting facility at the Hornby Island Waste Management Centre (HIWMC), as well as an alternate option of

collecting residuals at the HIWMC for transport to and processing at the Comox Valley Sewerage Service's (CVSS) biosolids composting facility in Cumberland.

- Study results indicate there could be as many as 175 composting toilets currently in use on Hornby Island. Management of residuals is identified as one barrier to increased composting toilet usage.
- The alternative option of collecting residuals at the HIWMC for transport and processing off-island is recommended in the study, as it provides the benefit of providing reliable data on residual material volumes and community interest in a local residuals management facility, at a reasonably low cost.
- Supporting the use of composting toilets on Hornby Island by providing a residuals management option could also provide water conservation and groundwater protection benefits.

Prepared by:	Concurrence:	Concurrence:
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Government Partners and Stakeholder Distribution (Upon Agenda Publication)

Ed Hoeppner, ROWP	✔

Background/Current Situation

In July 2016, the BC Ministry of Health published the Provincial Manual of Composting Toilet and Greywater Practice (link). The Manual provides a comprehensive set of provisions that support the design, installation and maintenance of composting toilet-based sewerage systems, and aligns with the *Sewerage System Regulation* (SSR), *Environmental Management Act*, *Municipal Wastewater Regulation* and BC Building Code. The Manual identifies composting toilets as part of a sewerage system under the SSR. A composting toilet system can now be filed as part of a SSR filing with the local health authority.

Among the provisions introduced in the Manual are new standards for the management of composting toilet residuals. The Manual specifies three options to manage composting toilet residuals including off-site discharge, on-site burial and on-site surface application. Monitoring and processing requirements specified in the Manual now make it more challenging for homeowners with composting toilets to legally discharge organic residuals on-site.

In May 2018, Ed Hoeppner, ROWP, presented information to the Electoral Areas Services Committee (EASC) on the new Manual and the challenges it presents for on-site residuals management. Mr. Hoeppner requested that resources be allocated to a feasibility study to evaluate options for a community processing facility at the Hornby Island Waste Management Centre. As discussed in Mr. Heoppner's presentation, it is expected that off-site discharge would be preferred by most homeowners, especially those new to composting toilets. A community processing facility would support the general development and use of composting toilets and enhanced household water efficiency.

The CVRD hired a team led by Ian Ralston, one of the authors of the Manual, to complete a study (Appendix A) of the feasibility of a community processing facility for composting toilet residuals. The study also included an evaluation of collecting residuals at the HIWMC and transporting to the existing CVSS biosolids composting facility for processing.

To investigate the number of homes and businesses using composting toilets on Hornby Island, the community was engaged through the availability of a survey, supported by a CVRD project webpage, news stories in local media and an information table at the Hornby Island Co-op. The survey was widely available in paper format and online, and completed by 185 individuals. Survey highlights include:

- 45% of respondents currently have a composting toilet.
- Of those that have a composting toilet, 37% would use an off-site residuals processing facility.
- Of those that don't have a composting toilet, 41% would consider installing one if it were easier to manage the residuals.
- 53% of respondents would be interested in using compost product from a central facility.

Through survey responses and discussion with Ed Hoeppner, it was estimated that there could be between 100 and 200 composting toilets in use on Hornby Island. The analysis in the report is based on an estimate of 175 households currently using composting toilets and growing to as many as 500 composting toilet households by 2050.

Based on this analysis of current use, the initial annual volume of composting toilet residual material for management at a central facility could be approximately 20 tonnes, or 30 m^3. Should future use of composting toilets grow to include up to 500 households, residual volumes could grow to as much as 60 tonnes, or 85 m^3. Use of composting toilets by one or more commercial users would see a more rapid increase in residuals volumes.

The report includes a summary of composting technology options, with a focus on aerated static pile (ASP) systems or in-vessel systems. Of the four systems assessed in the report, the O2 compost small-scale ASP system was found to be best suited, based on the current and anticipated volumes, cost of construction and ease of operation. Figure F-1 of Appendix A illustrates a typical installation of this type of composting system. Construction and operating cost analysis for the on-island processing facility option is based on the use of this composting system.

The report also includes analysis of an alternative option, consisting of establishing a local collection point where residents could drop off their composting toilet residual material for transport to an off island processing facility. For the purposes of analysis in the report, the HIWMC was selected as the local collection point, with the material being hauled to the existing CVSS biosolids composting facility in Cumberland. This option would require locating a sealed roll-off bin on site for collection of the residual material, and would have an added advantage of helping confirm volumes of residual material for processing at a potential future on-island facility.

In terms of regulatory requirements, a facility designed for processing composting toilet residuals would be regulated by the Organic Matter Recycling Regulation. Prior to operating, a notification to the province is required, consisting of facility design and operating details, types of waste received and intended distribution of compost. The property on which the facility is located will also need to have the appropriate land use designation; the Intergovernmental Factors section of this report includes further discussion on this.

The report highlights some benefits of increased composting toilet use resulting from reduced indoor water use, further resulting in reduced wastewater loadings to existing septic systems. This may improve the performance of these systems and increase their lifespans. A reduction in indoor water use would also reduce demand on Hornby Island's groundwater resources, which are already under significant pressure during the summer months.

Several concerns expressed during the outreach component of the study were in relation to potential impacts a local composting facility could have to groundwater. Any leachate produced during the composting process would be re-used in the process, and would not be discharged to the environment. The facility and curing/storage areas would be roofed, thus preventing any rainwater from contacting compost material and leaching nutrients into the environment.

A preliminary risk assessment as part of a recent CVRD study on mandatory maintenance program options for septic systems showed much of Hornby Island to be at elevated public and environmental health risk from failing septic systems. Supporting increased use of composting toilets by facilitating proper management of residual materials could help mitigate this risk through the diversion of the majority of nutrients and pathogens in human waste from sites which may have marginal septic systems.

Potential next steps recommended in the report include the following:

1. Further explore implementation of central collection of residuals and transport to the CVSS biosolids composting plant, including the following:
    - Present study results to Hornby Island Residents' and Ratepayers' Association (HIRRA) for discussion of operational impacts at the HIWMC and the potential role of volunteers in establishing and supporting collection of composting toilet residuals.
    - Confirm whether collection of residuals at the HIWMC and transport to the CVSS biosolids facility would be an appropriate fit within the scope of the existing Hornby Island garbage disposal service, function 360, under a full user pay cost recovery mechanism.
    - Confirm appropriate land-use with Islands Trust for collection and potential future composting.
    - Seek approval from the CVSS for processing of composting toilet residuals at biosolids composting plant:
        - Determine quality requirements, including conditions under which kraft paper bags could be accepted.
        - Establish a tipping fee to be charged for acceptance of composting toilet residuals.
2. Report back to broader Hornby Island community regarding study results, next steps, and future engagement opportunities.
3. Include composting toilet information (particularly related to proper management of residuals) in septic education program resources (for Hornby, Denman and other remote communities).

Policy Analysis

At its September 2018 meeting, the EASC passed the following motion:

> THAT an application be made to the Infrastructure Planning Grant Program for a feasibility study for a Hornby Island composting toilet residuals management service;
>
> AND FURTHER THAT the 2019-2023 financial plan for Service 155, Hornby Island Feasibility Studies, include up to $5,000 for the Hornby Island composting toilet residuals management service feasibility study for further consideration and approval.

The service establishment bylaw for the Hornby Island garbage disposal service, Bylaw No. 87, 1972 includes the following purposes:

a) The acquisition, maintenance, operation and regulation of grounds for the disposal of garbage and waste;
b) The collection and disposal of garbage and waste;
c) The provision of sundry services to community property.

Options

1. Further explore implementation of central collection and transport to off-island processing through the following:
    a. Present study results to HIRRA to discuss operational impacts at HIWMC;
    b. Confirm if central collection and transport can fit within scope of existing 360 function;
    c. Confirm appropriate land-use with Islands Trust;
    d. Seek approval from CVSS for processing residuals at biosolids plant; and
    e. Present study results to Hornby Island community
2. Develop composting toilet residuals management information for inclusion in CVRD's septic education program, targeted to residents on Hornby/Denman.
3. Explore implementation of a Hornby Island processing facility for composting toilet residuals.
4. Take no further action at this time.

Options 1 and 2 are recommended. Central collection of residuals and transport off-island will support the continued use of composting toilets on Hornby Island, while also providing the opportunity to collect reliable data on material volumes and community interest, supporting the potential future construction of an on-island processing facility. Supporting the continued use of composting toilets on Hornby Island is also important from a water conservation and groundwater protection perspective.

Financial Factors

High level capital and operating cost estimates are included in the report, and are summarized in Table 1 below. These estimates are based on the report's assumption of 175 composting toilets currently in use on Hornby Island, with up to 70% of these users choosing to transport their residuals to the composting or collection facility.

Table 1 – capital and operating cost summary

Option	**Capital cost**	**Annual operating cost**	**Total annual cost**
On-island composting facility	$75,000 - $145,000	$14,000 - $21,000	$17,750 – $28,250
On-island collection and transport off-island for processing	$5,000	$12,000	$13,000

For the purposes of estimating approximate user fees for the on-island collection and transport option, Table 2 below includes a range of composting toilet usage scenarios for comparison. Garbage collection at the HIWMC is charged by the bag, and a similar model is assumed for this table, with the rates being per 20kg bag.

Table 2 – User fee estimates for collection on-island and transport off-island option

# of composting toilets in use	User fee per 20kg bag	Approximate annual cost per participating household
90	$22	$180
175	$13	$110
500	$7	$60

The approximate annual cost per household is based on an assumption of 70 per cent of composting toilet users choosing to transport their residuals to the facility. All rates in this table are based on a total cost recovery model. These cost could decline in future years once initial investments required to initiate collection and transport are recovered. For some context on these costs in relation to septic system costs, an informal poll conducted at the septic education workshop on Hornby Island in June 2019 indicated that most residents pay at least $500 to have their septic tanks pumped, which would be required at least every five years.

The study was funded by $10,000 from the provincial IPGP program, and $5,000 from function 155, Hornby Island feasibility studies.

Legal Factors

A facility to process composting toilet residuals would have to meet the requirements of BC's *Organic Matter Recycling Regulation*. The facility would have to be located on land with a land-use designation that identifies composting as a permitted use.

The Hornby Island Waste Management Centre is operated by the Hornby Island Residents' and Ratepayers' Association, and is funded by the CVRD through the Hornby Island garbage disposal service, function 360. Further analysis and discussion with HIRRA is required to determine whether the composting toilet residuals collection and processing options presented in this report could fall within the scope of this service.

Should the on-island collection with transport off-island option proceed, an agreement with the Comox Valley Sewerage Service would be required prior to accepting composting toilet residuals for processing at the existing biosolids composting plant in Cumberland. This would likely include payment of a tipping fee for these residuals.

Regional Growth Strategy Implications

Hornby Island is not covered by the Comox Valley Regional Growth Strategy (RGS) as land use planning on the island is a responsibility of the Islands Trust. However, the onsite wastewater management initiatives described in this report will be developed to align with the goals and objectives of the RGS to "provide affordable, effective and efficient services and infrastructure that conserves land, water and energy resources."

Intergovernmental Factors

The consultant team sought input from Islands Trust staff regarding the existing land-use designation of the HIWMC site, and if a composting facility would be considered an appropriate use. Initial feedback from Islands Trust staff indicates that while "recycling depot" is considered a permitted use, a rezoning application would be required prior to processing or storing residuals from composting toilets. Islands Trust staff also referred to a clause in the Hornby Island official community plan, suggesting that a processing facility for composting toilet residuals be investigated through a comprehensive planning process, such as a liquid waste management plan.

The consultant team suggests that CVRD take the position that collection of composting toilet residuals for transport to an off-island location for processing is compatible with the site's "recycling depot" designation. This is supported by the BC *Environmental Management Act*'s definition of "recyclable material" that includes organic materials that are capable of being composted.

Interdepartmental Involvement
This report has been prepared by the Liquid Waste Planning staff of the Engineering Services Branch, with input from Comox Strathcona Waste Management services staff and Comox Valley Sewerage Service staff.

Citizen/Public Relations
As part of the study, public outreach activities included an online/paper survey, written articles in local media and in-person presence at an information table at the Hornby Island Co-op on two separate occasions.

Outreach activity revealed general support for the use of composting toilets, though there are concerns regarding potential groundwater contamination and odour associated with development of a community processing facility for composting toilet residuals.

Attachments: Appendix A – Hornby Island Composting Toilets Residuals Management Options, TRAX Developments Ltd.

TRAX DEVELOPMENTS LTD.

Box 9-6, Thetis Island, BC, V0R2Y0. T 250-246-4774 Fx 866-424-8569 onsite@traxdev.com

Report: Hornby Island Composting Toilets Residuals Management Options

Project: Hornby Island Composting Facility Study

Client: Comox Valley Regional District (CVRD)

Date: September 2, 2020

Introduction

The client has retained TRAX to identify and report on feasibility of options for off site management of residual organic matter from composting toilets on Hornby Island.

This report summarizes the outcome of our work on this project during summer and autumn 2019, and answers the following questions posed and tasks planned in the TRAX proposal of June 2019:

- Evaluate current and potential future demand (for management of composting toilet residuals) in the community together with community and stakeholder opinion and feedback, including consideration of on site discharge of residuals,
- Investigate feasibility of a central composting facility for residuals on Hornby,
- Evaluate alterative options for processing or disposal of residuals, and
- Report and presentation to the CVRD with evaluation of options, recommendations on preferred (residuals management) option and implementation plan.

Further, this report includes response to review by the CVRD of a January draft.

Project implementation was ordered in three main stages:

- Community engagement and sourcing background information
- Analysis of information from community engagement and other sources, followed by evaluation of technical and economic feasibility of central options
- Reporting

The reader is cautioned that information on the number of composting toilets (CTs) on Hornby Island is based on estimates and limited information from a public survey. Analysis is semi-quantitative or qualitative based on this data. The options analysis is therefore preliminary only and focused on exemplary options for the two alternatives; 1) central composting on island vs 2) central collection on Hornby, transport to and composting at a CVRD facility. If the project moves to implementation, we recommend further analysis prior to detailed design. Budget figures are indicative only, and intended for preliminary selection and comparison of options rather than fiscal planning.

Limitations

This report is subject to the attached statement of general conditions.

A. Community needs and priorities

A- 1 COMMUNITY ENGAGEMENT PROCESS

The Comox Valley Regional District's Hornby Island Composting Toilets Residuals Feasibility Study was initiated with community engagement in July, 2019.

Two alternative methods of management of composting toilet (CT) residual organic matter are either discharge on site in compliance with a filing and maintenance plan under the Sewerage System Regulation (SSR), or discharge to an approved off-site facility.

The focus of community engagement was to provide information and analysis about current CT usage patterns, current discharge methods and options for off-site management of residual organic matter from composting toilet systems on Hornby Island, considering an on-island central composting facility as well as central collection with discharge to an off-island composting facility.

Community outreach took place from mid-August till the end of September. Outreach by the TRAX team was led by Laura Busheikin, and undertaken in coordination with and with the support of CVRD staff.

A- 1.1 Outreach Activities

The following summarizes community engagement activities performed by the TRAX team in collaboration with CVRD staff:

- July CVRD website page on composting toilets created
- August 14 Survey distributed to every household as insert in the Hornby Island Tribune (circulation 520)
- FAQs about the study and link to the survey published on CVRD website, August
- August 15 Introductory article published in The Island Grapevine
- August 17 Survey and FAQs posted on bulletin boards and placed in public locations on Hornby
- August 24 Information and engagement table outside Hornby Island Coop Store
- September 2 Follow-up article published in the Hornby Island First Edition
- September 21 Information and engagement table outside Hornby Island Coop Store
- September 25 Advert published in Hornby Island Tribune
- September 26 Article published in The Island Grapevine
- September 28 Information and engagement table outside Hornby Island Coop Store
- In addition to the above, there was also ongoing social media engagement on the CVRD Facebook page and in the Hornby Island Community Connections Facebook group.

A- 1.2 Survey

A simple survey form was developed, and is attached as an appendix to this report.

The survey was made available in paper form to all households on Hornby and at public sessions. An online version was hosted by CVRD.

Data input was by CVRD staff, and analysis by the TRAX team.

A- 2 OUTCOME

A- 2.1 Summary

Overall, the high rate of survey returns and the enthusiasm encountered at the table sessions suggest that Hornby Islanders are very interested in composting toilets. Some participants expressed, either through the survey questionnaire or informally in conversation at table sessions, concerns about CT residuals generally, and around the idea of a residuals processing facility on the island. No participants spoke against the use of composting toilets generally.

Many participants said they see composting toilets as effective ways to practice water conservation and lessen the impact of septic systems on the environment. Numerous participants showed interest in learning more about composting toilets.

A- 2.2 Common concerns

Common concerns expressed at table sessions and in the responses to the survey included the following:

- Potential for impact on the watershed and groundwater
- Impact of contaminants, including pharmaceutical residue
- Potential for odors
- Safety of final product
- Use of tax funds and project cost

A- 2.3 Highlights of the Survey

185 people completed the survey—107 people on paper (either dropping it off at the Freepost or submitting it at a table session) and 78 on-line. Of those respondents:

- 45% have composting toilets
- 57% of people with CTs use the residuals on plants; 28.05% bury the residuals
- 37% of people with CTs said they are very likely or likely to use an off-site residuals processing facility
- 41% of people who do not have CTs said they would consider installing a CT if it was easier to manage the residuals; 30% said they were not sure
- 25% of people who do not have CTs said they would consider using an approved off-site composting facility for residuals if they had a CT; 25% said they were likely to use one; 23% said they didn't know
- 34% of survey respondents without composting toilets indicated that they would consider use of composting toilets if a central collection facility was available.

- 53% of respondents in the survey indicated they would be interested in using compost product from a central facility, and 23% were unsure

In addition to completing the survey questionnaire, many people added freeform comments to their surveys (see Section A- 2.4). 80 people engaged in conversation during the three table sessions.

Survey data, which is anonymous, is held by the CVRD in spreadsheet data table format.

A- 2.4 Freeform comments

The survey included a freeform question to allow for input beyond the standardized survey questions. Further freeform feedback was recorded from table sessions, calls or contacts to the CVRD office (2 responses), and Facebook (9 responses)

We evaluated themes within these comments, beyond basic support or opposition (which are captured in the survey data analysis discussed above). This evaluation identified the following themes and number of respondents for each theme:

- More education on composting toilets and residuals management is welcome: 21 responses.
- Interest was expressed in testing for residuals: 3 responses.
- Untreated residuals are safe for use (this only reflects comments that directly stated this, and not people who simply said they use their residuals in their garden, orchard, etc.): 15 responses
- A barrier to a centralized facility is that composting toilets are hard to use and/or expensive: 10 responses
- Not supportive of a processing facility and/or use of the product due to concerns about contaminants: 14 responses (of this 14, six identified pharmaceuticals as their concern)
- Concerns about possible impacts on the watershed or groundwater next to the Hornby Island Waste Management Center (HIWMC): 7 responses
- Does not support the use of tax money to invest in a central composting facility: 6 responses

A- 3 COMPOSTING TOILET USAGE AND UPTAKE

Survey data were analyzed to provide estimates of usage, uptake and potential residuals volume for central collection. Analysis took into consideration permanent residents vs seasonal residents and transient usage.

This analysis was supported by Census data, a past Hornby Island housing survey and comment from a contractor with experience in the use of composting toilets on Hornby Island.

A weakness in the data is the lack of any absolute count of current numbers of composting toilets on Hornby. We estimate that Hornby Island could have 100-200 residential CTs currently. After discussion with CVRD and comment by their sub contractor we based analysis on an estimate of 175 households with composting toilets.

It also appeared that the survey responses were skewed toward permanent residents, under reporting for seasonal and transient users. In analysis we corrected data based on census information.

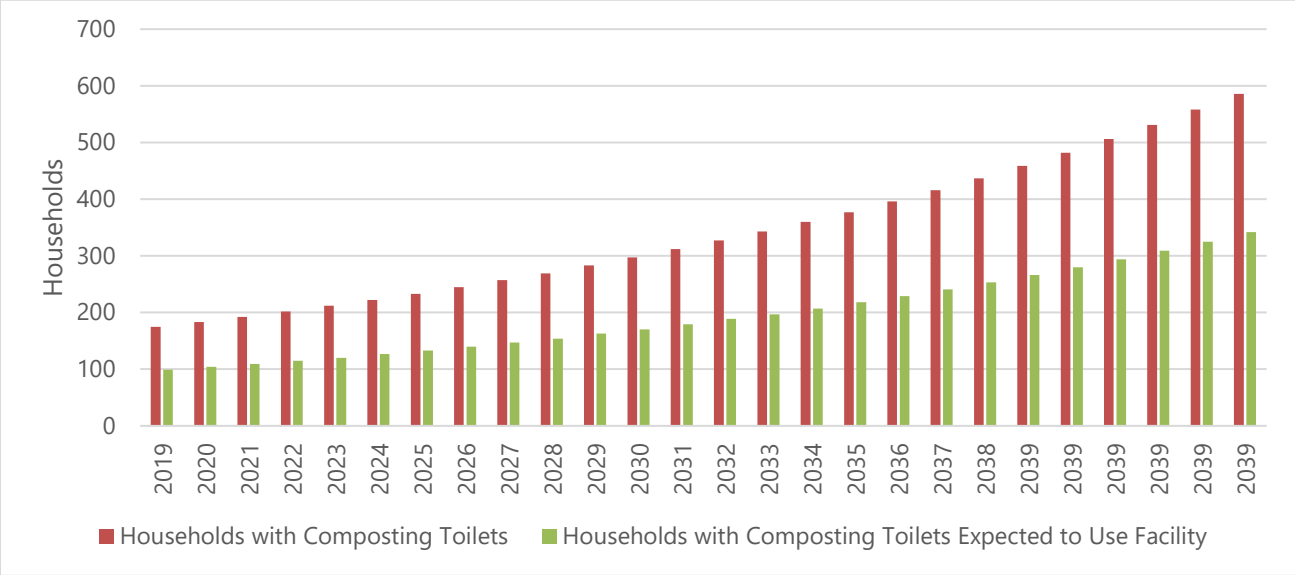
Based on the assumed current number (175) and analysis of survey data (See Section A- 2.3), current uptake of composting toilets (CT) could grow to over 500 residential CTs within the next 25 years, particularly where central collection of residual organic matter is available.

Central collection is expected to support adoption of composting toilet systems. As noted above, 34% of survey respondents without composting toilets indicated that they would consider use of composting toilets if a central collection facility was available.

There is also the potential for commercial establishments (e.g. the Hornby Co-op) to invest in composting toilets where central collection and on or off island processing is available. Note that we have not included this potential in modeling because even scoping projection is not practical based on available information, but have considered it in relation to the importance of a flexible facility for residuals management.

The Figure A- 1, below, illustrates projected uptake over the 25 year period based on this analysis.

Figure A- 1. Projected Uptake of Composting Toilet and Facility Use on Hornby Island



A- 4 ANNUAL RESIDUALS PRODUCTION

Based on survey results we estimate that 50% of permanent dwellings with composting toilets and 70% of seasonal dwellings with composting toilets would be interested in discharging their residuals to a central processing facility.

Survey data also indicates that there would be an increase in uptake of CT use if a central collection option were to be available.

For feasibility assessment we have based a 25 year projected usage of a central collection facility or system on an annual person equivalent usage of 450 persons.

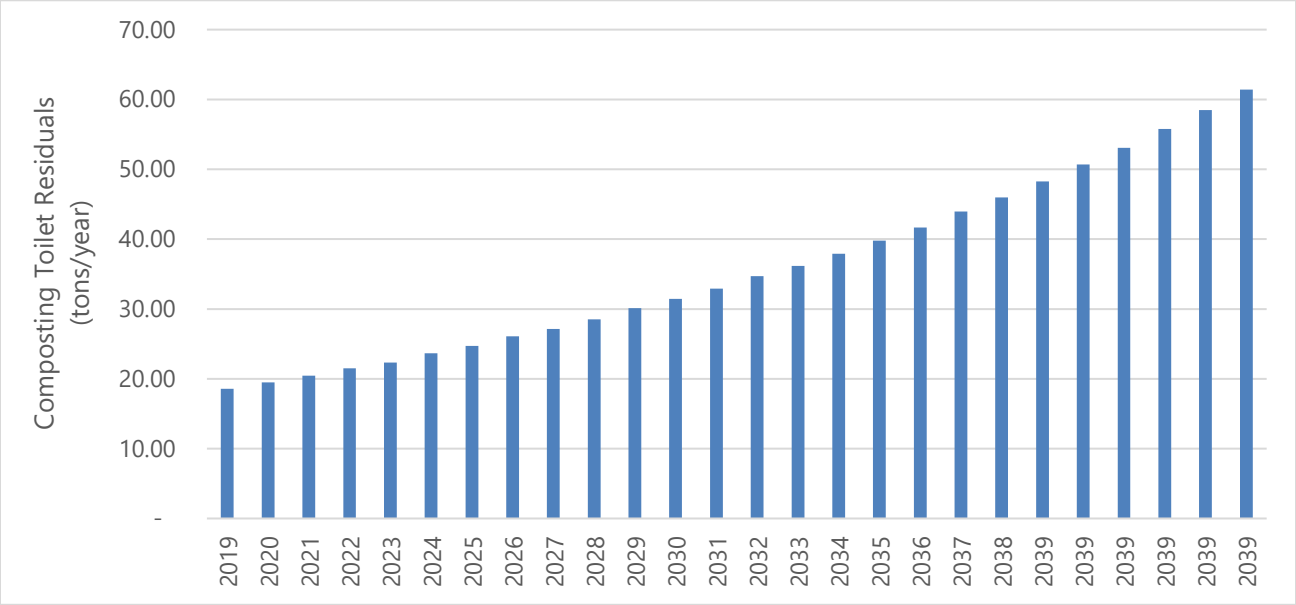
This would equate to an annual waste mass from CTs at the 25 year projection of approximately 60 tonnes. Assuming a density of 700k g/m3 due to the mix of raw and degraded nature of some of the residuals, this would mean an annual volume accepted at the central facility of 85 cubic metres.

For assumed current usage of 175 CT systems, and with 48 to 70% uptake of facility use (permanent vs seasonal or occasional users), resulting in an annual person equivalent of 157 the potential initial annual waste mass from CTs could be approximately 20 tonnes or an annual volume accepted at the central facility of approximately 30 cubic metres.

The Figure A- 2, below, illustrates potential growth of projected quantity of residuals received at a central facility over the 25 year period.

If one or more larger commercial users, for example the Co-Op, seasonal venues, existing pump out toilets or a resort, decided to use the facility for residuals from composting toilets this would lead to more rapid increase in residuals volume, and a greater overall volume at the 25 year projection. Given that projection of these uses is not practical with the information available, we have **not** included potential volumes within our overall projection which is based solely on residential users. However, this potential for larger scale use supports the importance of a facility capable of modular expansion.

Figure A- 2. Projected Quantity of Composting Toilet Residuals Managed by Proposed Facility



A- 5 POTENTIAL WATER USE SAVINGS AND WASTEWATER REDUCTION

When considering sustainability advantages conferred by support to composting toilet systems, water savings and reduction of wastewater flows are key factors identified both from a technical perspective and by community members.

Based on median water use data utilized for development of the BC Manual of Composting Toilet and Greywater Practice (MCTGP), and 450 person equivalents per annum at the 25 year projection, water saving through composting toilet use for persons using the facility would be in the order of 8400 cubic metres per annum at the 25 year projection. For all residential composting toilet users at the 25 year projection the saving would be in the order of 11,000 cubic metres. Any commercial use would increase overall water savings.

Based on a total population equivalent for the island at the 25 year projection of 1366 persons and a per person indoor water use of 170 L/day overall water use for residential indoor purposes on the island could be in the order of 85,000 cubic metres per annum, for comparison.

A similar reduction in discharge of liquid waste to onsite sewerage systems would be expected, although some leachate flow must be addressed by these systems. This reduced discharge may improve performance of existing onsite systems and increase their lifespan.

B. Options for management of residuals

B- 1 RESIDUALS MANAGEMENT OPTIONS

There are two options for regulatory compliant waste management for the residuals produced by CTs.

Firstly, on site discharge. Assuming the CT installations are compliant with respect to the BC Ministry of Health Manual of Composting Toilet and Greywater Practice (MCTGP) owners may treat the residuals onsite and discharge them into the soil under the supervision of a professional or ROWP (Registered Onsite Wastewater Practitioner), under the Sewerage System Regulation (SSR).

Secondly, off site discharge to an approved facility. The facility could simply be disposal (e.g. an approved landfill), or an approved composting facility that could accept the residuals.

B- 2 CENTRAL FACILITY OPTIONS FOR OFF SITE DISCHARGE

Based on the proposed scope of this study, we did not evaluate options for individual users to transport residuals to an off island facility, and we did not consider disposal to a landfill. We do note that, based on data from the community engagement survey, it is unlikely that these options would be favored by users on Hornby Island.

For off site discharge we considered provision of a central collection facility on Hornby Island, with subsequent processing of collected residuals at a facility compliant to the BC OMRR (Organic Matter Recycling Regulation).

There would be two options for operation of the central collection facility:

The first option would be to collect the residuals at a central on-island composting facility. An example of this would be an aerated static pile compost facility that is appropriately sized for the CT residuals plus the fresh bulking agent they need to assure bio-oxidation and pathogen reduction temperatures of >55C for three days (per BC OMRR).

The second option would be to centrally collect the residuals and then transport them off island to an approved facility. For this option the preferred approach would be to transport the residuals to the CVRD Biosolids composting facility, located at 3781 Bevan Road, Cumberland.

The second, off island, option could also be implemented initially and followed later with development of a central composting facility on island.

C. On site discharge of residual organic matter

Detailed evaluation of the on site discharge option was out of scope for this study, however some basic information was solicited during community engagement. The survey indicated that some owners discharged on site by using on the surface on plants, some by burial and other owners stored or did not use the residuals.

Based on survey responses and input at table sessions we consider that there is community interest in educational outreach to better support operation of composting toilet systems and the safe, hygienic, on site discharge of residual organic matter.

We consider that this outreach could be effective in improving health and environmental protection, given that several responses and informal discussion indicated a lack of understanding of risks attached to residuals management on small sites.

We recommend that this information be incorporated into the existing CVRD septic education program which supports on site wastewater management, and we recommend that this be implemented for Hornby Island and considered for Denman Island and other rural areas where composting toilet use is common.

Given that on site discharge is considered likely to continue to be used even where a central facility is available, we consider ongoing outreach and education to be an important part of the Hornby Island waste management strategy. We also recommend that if a sewerage system maintenance bylaw is implemented in the future, the CVRD include wording that addresses monitoring of on site discharge.

One potential outcome of educational outreach is likely to be increased uptake of use of a central facility.

There will also be a need for access to residuals testing, which might be a service that could be provided by the CVRD at the central facility on a fee per use or gratis basis.

D. Collection of residuals at a central facility

Based on discussion with CVRD staff and with island residents, household pick up collection of residuals may not be feasible at this time. This is because of the small number of toilet systems, the infrequent and unpredictable nature of discharge requirements and the way in which residences are spread over the island. This is, of course, somewhat of a chicken and egg situation.

There are some important advantages to pick up, including:

- More reliable control of residual quality
- Enhanced opportunity for educational outreach during collection
- Better risk management in terms of health hazard, odor and system operation
- Reduced risk of spills, negative impacts on other users and other issues at the facility
- Avoids the risk of users missing the time at the facility and depositing the material in the wrong place or outside the gates.

One suggestion was for monthly pick up. If strongly desired by users or the community this option could be supported by, for example, volunteer effort. We recommend that this option and the cost benefit be further explored during the detail design stage, but we have based our analysis in this report on user drop off.

The community is accustomed to utilizing a central drop off for recycling and other waste, and this has been standard practice on the island for several years.

We recommend considering a central drop off location, co located with the transfer station or composting facility. This report assumes the facility would be located at the Hornby Island Waste Management Center (HIWMC) (3600 Central Road, Hornby Island). We recommend considering operation of the facility at specific times or days each week, for times when a staff person or contractor is on site (either for operation of the composting facility or for other work at the yard). Current times of operation of the HIWMC are reported to be 0900 to 1300 three to four days per week, receiving could take place on all of the days or on one defined day depending on staffing impact.

To reduce risk of spills and health risk during transportation it will be necessary to accept residuals in bags. Plastic compostable bags tend to not compost well at simple composting facilities (particularly where materials are not ground), and CVRD reports issues with them at their facilities.

To address this issue we recommend considering use of kraft paper bags. These bags could be provided at the central facility so that users could take a new bag or bags when making a deposit. Alternatively, a specification could be provided and users would purchase the bags from hardware stores.

It may also be necessary to specify acceptable quality of CT residuals, citing, at minimum, moisture content and absence of non compostable trash or toxic materials. This could be articulated as a source control policy, and might reasonably be printed on the paper bags if these are supplied at the facility. The purpose of doing this is to reduce risk of impact on the facility and finished product, and to reduce health risk during transport of the bagged material to the facility. Some education outreach may be necessary to support this. We do not contemplate regular testing of materials when users drop them off, but rather a policy being in place to establish expectations and manage issues that may arise.

The MCTGP includes the following recommendations with respect to off site discharge:

> *"If off-site discharge is planned, sanitizing or curing is not a necessity, but can be used to make material safer to handle during discharge, or to provide volume and mass reduction."*
>
> *"In some cases, it may be preferable, and reduce risk, if residual organic matter is stabilized and even sanitized prior to off-site discharge. For example, where the material needs to be manually carried from the site."*

For the off island composting option (see below) we are recommending the use of a 12 yard roll off bin, that can be sealed. A lock block wall may be helpful to facilitate use of the bin. A similar bin system may be suitable for collection for a central composting facility, or smaller plastic bins (recyclables bins with lids) could be used. Purchase price of a 12 yard storm proof roll of bin is in the order of $3500.

If a larger commercial user, for example the Co-Op, a seasonal venue or a resort, decided to use the facility for residuals from composting toilets a special drop off or pick up option would be needed for these larger volumes. This could be developed at the time, as and when needed. It is possible that if the existing pump out public toilets located were converted to composting toilets (which we understand to be under consideration) then this network might help support pick up collection.

E. Potential location for central facility

E- 1 HORNBY ISLAND WASTE MANAGEMENT CENTER

The Hornby Island Waste Management Center (HIWMC) or Hornby Island Recycling Depot (3600 Central Rd, Hornby Island) is the central waste management centre on Hornby Island. The Depot accepts a diversity of waste for management: organic waste, recyclable and non-recyclable waste, clothing, scrap metal, drywall, construction wood waste, and used appliances.

The Depot does not accept some materials (e.g. lightbulbs or ballast), but in general the Depot has a strong culture of reuse and recycle. The Depot operates a Free Store where residents and visitors can exchange used goods like clothing, books, and appliances.

The Depot composts some of the organic solid waste (some kitchen waste, yard clippings, and wood waste) on-site, and the remainder of municipal solid waste is shipped to the Comox Valley Waste Management Centre (CVWMC).

The Depot ships one 40-yard container a month to CVWMC in the winter and 2 40-yard containers a week during the summer. The significant difference in municipal solid waste production is attributed to the influx of tourists and visitors during the summer. Construction wood waste and large branches are also shipped to the CVWMC (approximately 6 40-yard containers per year). The two wood streams (clean and dirty) are separated at source and managed separately by the CVRD at the CVWMC.

The CVRD has indicated that, for CT residuals, the Depot is the most likely site of a central collection depot and of any residuals processing facility.

The Depot currently has and manages a composting toilet for visitors and employees, see Figure E- 2.

Figure E- 1. The Hornby Island Recycling Depot welcome sign

Figure E- 2. Entrance to Hornby Island Recycling Depot's composting toilet

E- 2 ZONING

We have asked the Islands Trust for comment on current zoning and whether rezoning might be required. Currently the zoning is PU(a) which allows for use as a Cemetery, Public Utility Storage Yard, Highways Maintenance Storage Yard and Recycling Depot. A response from Islands Trust staff is attached for reference.

We note that current use includes collection of wastes for off island transport. Whether continued use for waste transfer needs rezoning should be confirmed prior to decision on options and siting for a central collection and transfer facility.

A review of the Land Use Bylaw shows that the Islands Trust has not defined "Recycling Depot". However, the *Environmental Management Act* provides a definition of "recyclable material", which includes organic materials that are capable of being composted. This definition supports continued use of the site for the collection and preparation of compostable materials for transport.

Based on the response from the Islands Trust staff it does, however, appear that rezoning will be needed for use as a composting facility for residual organic matter from composting toilets. Rezoning is reported to cost $5000 in fees to Islands Trust plus costs for management of the application by the client's designer or planning staff.

We recommend that the CVRD contact the Islands Trust and clarify requirements for each option, and suggest that the CVRD take the position that use for collection and transport of wastes (for recycling) is consistent with use as a "Recycling Depot".

F. Feasibility of a central composting facility on Hornby Island

F- 1 ON-ISLAND COMPOST FACILITY

It would be practical to compost the CT material on island with sufficient bulking agent (ground wood or yard waste) which could also be sourced locally to reduce off island trucking costs. Additional bulking agent is also available from the CVRD solid waste management operation as a back haul in bins that are normally brought to Hornby for garbage collection. Carbon-rich materials are useful as a bulking agent to adjust mixture quality, achieve desired moisture content, increase porosity, and optimize the composting process.

A small scale composting facility could be constructed and used to process the CT material into finished product, complying with the BC OMRR, and provide the finished compost back to residents of the island. The CVRD already produces and sells compost containing biosolids (www.comoxvalleyrd.ca/skyrocket).

F- 2 REGULATORY APPROVALS

Due to the small annual mass and volume throughput of the facility (<200 tonnes) the Provincial permit process is substantially easier than if the facility were to process >20,000 tonnes. At the 20,000 tonnes threshold an Environmental Impact Study would need to be conducted. The facility envisioned would need to hire a qualified professional (QP) in B.C. to develop a facility design and set of construction plans.

At 90 days prior to operation, notification must be made to B.C. OMRR director. The notification iinclude the facilities operating plan (personnel training plans and procedures to maintain compliance with the OMRR). The recommended technology supplier provides detailed construction and operational plans, so most of the effort by the QP would focus on the civil plans, grading, stormwater, and leachate management in order to ensure compliance with the OMRR. The requirements for leachate and stormwater design and operation are well described in Division 3 of the Regulation.

The site chosen for the composting facility will need to have the appropriate land use designation / zoning or apply for re-zoning. See above.

F- 3 TECHNOLOGY OPTIONS

There are several simple, technically practical, methods for composting organic waste. From simplest to most complicated, these methods are as follows: static pile, turned windrow, aerated static pile (ASP), in-vessel (vessel). The simplest two methods have little in the way of process control and these facilities tend to generate 10 to 100 times more odor than the ASP and vessel methods. It is difficult to permit the static pile and turned windrow in BC under the BC OMRR.

There are also several more complex or innovative options available, including pyrolysis, anaerobic digestion. At the feasibility stage we have confined our review to simple, well established options which are likely to be familiar to CVRD operations staff. At predesign it may be appropriate to explore these (generally more costly) options.

As noted in Section A- 4 it is important that any facility be capable of modular expansion to address the potential for future uptake by either larger numbers of residential users, or by commercial users.

Based on these considerations, on a small island, for local processing of composting toilet residuals, we recommend ASP or vessel systems. ASP and vessel systems provide the process control necessary for keeping the process mostly aerobic (as opposed to predominately anoxic as in a windrow process), optimized (rapid decay), and capable of scrubbing odors from the emitted air. These systems tend to be much smaller in footprint than their static and windrow equivalents, and thus they can be cost effectively covered to minimize the impact of rain and generation of leachate. ASP and vessels dry out the material being processed much faster than static pile and windrow and this minimizes leachate production and also allows for the re use of any leachate produced in the process.

Four local suppliers of complete ASP and vessel systems were contacted regarding this project; ECS (Seattle, WA), Green Mountain (Bainbridge Island, WA), O2 Compost (Edmonds, WA), and Sustainable Generation / GORE / NetZero (Abbotsford, BC). As the current study is for feasibility review only, it is not appropriate to make firm recommendation of a process option. However, for consideration of cost and operation and maintenance it is necessary to consider which supplier and process might be most suitable. At predesign we recommend options analysis, including consideration of commercial systems and custom designed solutions.

ECS

A vessel system from ECS will start at around $250,000 plus installation. The smallest ECS vessel systems serve to process 1000 tonnes per annum of biosolids (5-10x more than this project will generate). ASP systems from ECS start around $100,000 with an installation cost of around $200,000 (per the most recent small ASP installation at the Woodland Park Zoo in Seattle in 2019); together the equipment and construction cost will likely price the technology beyond reasonable feasibility for the Hornby case.

Green Mountain

Free standing mixed vessel systems (Earth Flow) from Green Mountain have not had favorable long-term reviews. Their small tubs are not currently produced and their new Earth Cubes appear to be little more than containers with an access hatch. Emails to the principal, Michael Brown, regarding this project were not returned. Based on these issues, we have not further considered their technology for the feasibility study.

GORE / Net Zero Waste

The GORE system has been in use at the CVRD and the CVRD have been satisfied with the process. Mateo Ocejo was contacted and an estimate was supplied; this system would be very small for the GORE technology but would be designed to provide two small covers with two control systems and pipe on grade aeration delivery. The budget technology cost supplied was $100,000 as of emails Nov. 20th 2019. This assumed that the site was prepared (hard surfaces under the piles with power and water brought to the site.

O2 Compost

O2 compost has provided thousands of small-scale ASP systems to small municipalities, institutions, and businesses all over the world, including in Canada. What is unique to his business and technology offering is provision of the critical process control (aeration through an aeration floor and fan) design (construction plans) and support (he is an industry expert in process and operations). Of note is that he does not supply any structural parts, leaving the simple construction to be conducted by local contractors.

This results in a high-quality package for small sites with a very low constructed cost. The O2 Compost equipment supply with construction plans costs $8000. Peter Moon of O2 Compost estimated a (low end) construction cost of $33,000 for this 4 bin system with an adder of $13,000 for remoteness (ferries etc).

The rendering below (Figure F- 2) was supplied to a general contractor for a (high end) construction cost (+/- 30%). The supplied estimate was ~$100,000.

The total installed cost of this system is likely to be <$60,000-$120,000. Note that this cost does not include design phase costs such as regulatory approvals, rezoning etc.

There are important advantages to using a dedicated small loader for the facility, of key importance is that this would reduce risk of inadvertently spreading contaminated material over other parts of the site, and given that the current backhoe does not have quick change bucket capability so is not suitable for the interchangeable bucket approach we recommend consideration of a small second-hand loader or skid steer for the facility. We have not included this in the capital estimate as a specific line item, but if an economical approach is taken to construction (as recommended above) then such a machine would fit within the budget range recommended.

We have assumed that record keeping would be handled by staff without the need for dedicated facility for this.

Figure F- 1. O2 Compost Facility Example (3 bin system)

From O2 Compost website, note blower at left of photograph.

Technology Provider Recommendations

ECS, GORE, and Green Mountain supply most of the equipment for which there is considerable markup, transportation cost, and a complicated installation. O2 Compost supplies the minimum key equipment and detailed construction plans which have been used and refined thousands of times, minimizing engineering costs and complex installation.

For these reasons, we consider that for the size of facility contemplated on Hornby, an O2 Compost system is likely the best fit. We have selected this option as representative of on island composting for the feasibility study.

F- 4 CAPITAL COST

For consideration at this preliminary feasibility stage, an indicative cost for construction of a CT residuals composting facility is in the range of $60,000 to $120,000.

This does not include purchase of a new backhoe or loader, which we understand to be under consideration for the recycling yard as a whole. See note above on recommendation for a dedicated machine for the facility.

Cost for a design phase, with regulatory approvals is expected to be in the range of $10,000 to $20,000 including allowance for time on the part of the designer related to rezoning, if needed. At the end of the detail design phase estimation of a Class C budget would be practical.

The CVRD would need to budget for staff time related to community engagement, design and rezoning, as well as a $5000 fee to Islands Trust if rezoning is necessary.

F- 5 FEEDSTOCK MIX SUMMARY

The input feedstock mix for a typical aerated static pile processor (ASP) would be comprised of the CT residual, yard waste, ground wood, and leachate.

The objective of the mix and process is to compost the CT residuals in accordance with regulatory requirements. Bulking agent and fresh material is necessary for this type of process, pure CT feedstock may not heat up to pathogen destruction temperatures.

Bulking agent of equal mass to estimated CT residual mass has been included to budget for necessary bulking agent and fresh material in the facility sizing. The key parameters of the mix have been included in order to bring the final mix to a Best Management Practices (BMP) mix for C/N, moisture, density. The resulting parameters shown have a very high likelihood of providing an ideal mix.

As discussed below, the need for the additional feedstock is an opportunity for co composting with any wood wastes collected as waste on Hornby Island and currently trucked off island. If added energy is needed in the mix, co-composting with food wastes may also be a consideration.

Given the widely varying type of toilet systems, and the mix of full time and seasonal population, accurate estimates of the quality of the CT residuals material is not practical at this time.

During the design phase we recommend more detailed assessment of residuals quality, in order to inform process design. We note that a potential advantage of initial operation of the facility as collect and truck off island is that this would give opportunity to confirm volumes and test quality.

Table F- 1, below, summarizes conceptual design basis for an ASP mix.

Table F- 1. CT Mix Recipe Analysis: Summary of necessary bulking agent and leachate additions so as to meet BC OMRR requirements for time and temperature for pathogen destruction (>55C for >3 days in an Aerated Static Pile processor).

Compost Mix Calculator

Color Key — **Cell Shade Key**

Survey Assumption | Assumption | Blue shade = inputs | *Grey shade = calculations*

Material	Metric Tons (mt/yr)	Wet Wt. (tons/yr)	% Moisture	C/N Ratio	TN	H2O wt	Dry Wt	Nitrogen - wt	Carbon - wt
Fresh CT Residuals	30	33	55%	15	1.0%	18	15	0.1	2.2
Decomposed CT Residuals	30	33	55%	10	1.0%	18	15	0.1	1.5
Yard waste	30	33	50%	35	0.7%	17	17	0.1	4.0
Ground wood	30	30	35%	100	0.20%	11	20	0.0	3.9
Leachate	7	8	100%	0	0.10%	8	0	0.0	0.0
Totals	**124**	137				71	66	0.5	11.7

Calculated C/N Ratio of the Mix 26

Calculate the Mix Volume & Moisture Addition Required

Estimated Feedstock Characteristics

Material		Wet Wt. (tons/yr)	% Water	Density (lb/cy)	H2O wt (tons)	Dry Wt (tons)	Volume (yd3)
Fresh CT Residuals		33	55%	1,100	18	15	60
Decomposed CT Residuals		33	55%	1,200	18	15	55
Yard waste		33	50%	700	17	17	94
Ground wood		30	35%	400	11	20	150
Leachate		8	100%		8	0	
Totals		137			71	66	359

Volume Reduction From Mixing 5%

Results			**BMP Range**	**BMP Assessment**
% Moisture of the Mix		**52%**	50-60%	OK
C/N of the mix		**26**	22-40	OK
Total Mix Volume (with mixing reduction)	yd	**341**		
Total Mix Density (lb/yd)	lb/yd	**801**	800-950	OK

F- 6 CO COMPOSTING OPPORTUNITIES

The Hornby Island Recycling Depot currently accepts yard and kitchen waste (SSO) for composting on-site. People are permitted to drop off acceptable wastes for composting during the Depot's operating hours: 9AM to 1PM from Thursday through Sunday in the winter and Friday through Sunday in the winter. There are restrictions on what material is accepted at the Depot. It is our understanding that the composting facility may not be OMRR compliant.

Based on estimates for annual production of compost at the Depot, the Depot is likely to be composting approximately 340 cubic metres of wastes per annum.

CT residuals primarily need bulking agent in order to create a BMP mix and compost properly. However, if the majority of the CT residuals are very well decomposed, they may not offer sufficient energy for self heating and thus make the attainment of thermophilic temperatures challenging. If this were the case, it may be advantageous to add a high energy waste source such as source separated organics (SSO) from residences on Hornby.

The addition of SSO and the food waste that comes in this waste stream would add more than enough energy to the CT residuals to ensure heat up.

However, there are a number of challenges that will come with the addition of food waste to this small composting system, including the following:

- The CVRD is currently developing a full-sized facility (at RFP stage) for the composting of SSO and this may remove feedstock from a Hornby Island facility if SSO was to be collected from Hornby Island. We understand that the CVRD is not planning this in the near term, so this may not be a significant concern.
- If not processed with considerable attention to detail, SSO composting can create excessive odor due to large demand for oxygen associated with raw food waste.
- CT residuals contain materials which have already decomposed inside peoples intestines and also degraded with time during storage at the residence before being dropped off at the transfer station. This reduces their oxygen demand and decreases their propensity to create odor.
- Inert contamination commonly comes with SSO that degrades the value of the compost end product. This inert contamination does not usually come with compost toilet residuals from residences because only fecal wastes and toilet paper, together with clean bulking agent, are being deposited.

From a mass balance perspective, 50 – 100 tonnes of bulked SSO would be more than sufficient to provide the necessary self heating energy within the bulked CT residual mix. This would increase the size of the facility 25-50% beyond that outlined above. This would increase the associated capital cost. If co-composting is to be pursued, added capacity could be added at a later date by adding extra bins to the four bin system evaluated in this report. Operational cost impact may be offset by reduced cost of trucking off island, in the case where co-composting is implemented.

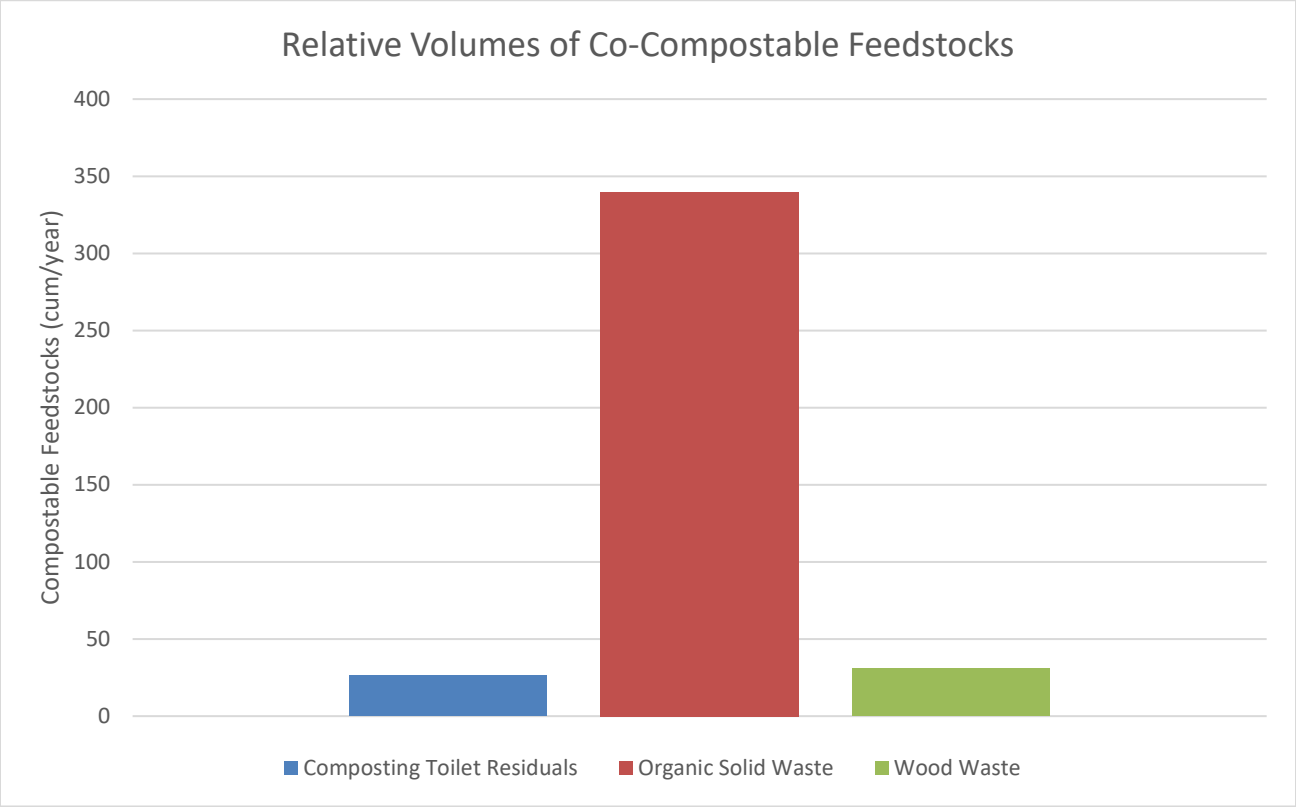
We recommend that, during preliminary and detail design of a composting facility for CT residuals, the annual volume of SSO and clean wood wastes coming in to the HIWMC be assessed in order to provide further information relevant to decisions over co-composting.

Clean, ground, wood wastes would be a suitable amendment (bulking agent) for the facility. If these wastes can be reliably sourced on island, and are utilized as bulking agent for the CT residuals composting, there will be a saving to the CVRD because they will not need to incur the cost of trucking them off island for composting.

Note that we have, in our operating cost estimates for a composting facility for CT residuals, based our estimates on supply of clean wood wastes for bulking agents and biocover from off island—this is because these materials could be trucked over as a backhaul at low cost.

Based on estimates for annual production of compost at the Depot, and on population data, with consideration of normal Canadian population average SSO production of 0.43 kg per person per day, we estimated relative volumes of SSO and wood waste that could be available at the HIWMC. Figure F- 2, below, illustrates our understanding of current volumes of SSO and wood waste at the HIWMC in comparison to the expected volume of CT residuals.

Figure F- 2. Comparison of waste volumes at the HIWMC



F- 7 SUMMARY OF SIZE & VOLUME CALCULATIONS

Composting has three basic phases; active (pathogen reduction), curing, and storage. Active composting of difficult feedstocks in sensitive areas should be done with forced aeration for greatly improved process control, speed, and odor minimization.

The size of the active composting component of the composting facility is provided in Table F- 2, below. Curing and storage can be done in unaerated piles without significant odor risk if the material has been well composted during active composting. Curing and storage should be conducted on an improved surface and will benefit from a roof or shelter to prevent rainfall saturating the material in the winter.

Table F- 2. CT Residuals Compost Facility Size and Design Summary for Aerated Static Pile

Feedstock Mix		
CT residuals	tonnes	60
Bulking agent	tonnes	60
Leachate	tonnes	7
Total	tonnes	127
Estimated density	kg/m3	475
Estimated annual volume	m3	260
Primary Composting - containerized covered aerated static piles		
Retention time	days	45
Bin width	feet	8
Bin depth	feet	8
Material depth	feet	4
# of bins	#	4
Days to fill a bin	days (365d operating)	10
Days to fill a bin	days (260d ops)	14

This table is based upon the 25 year volume projection. For initial operation, volumes may be 65% of that at 25 years, or less. Thus bin fill time, based on 260 day operation, would be 21 days or greater, and annual volume produced would be 170 cubic metres or less.

F- 8 FACILITY OPERATIONS

As discussed above, collection to the facility was assumed be by owner drop off for the purpose of this report, however pick up options would result in similar facility operation—the only change would be in the collection stage.

Management of the facility could be by community members, a mix of paid and volunteer staff or completely by HIWMC staff. It will be important to ensure responsible and consistent management of the facility and of its operation, and we recommend establishing a clear management and process model during the detail design and implementation stages.

The four bin system illustrated above would be powered by a single blower and operated by a single laborer with a small tracked or wheeled machine like a skid steer or tractor, which would not necessarily need to be dedicated to the site.

The bins are 8' wide and would accommodate most bucket implements. Due to the feedstock which could contain raw human waste, it is likely that a dedicated and detachable bucket would be used for this operation and left onsite. This bucket would need to be cleaned and sanitized when left onsite to prevent odors and vector attraction and cleaned and sanitized prior to handing finished compost (post pathogen destruction).

The following is a step by step program for the operation and loading / unloading this system.

- Gather feedstocks until sufficient volumes are held for creation of a batch (one 8'x8'x4' bin)
- Mix feedstocks together thoroughly with the loader bucket.
- Add leachate if collected and the mix requires additional water content (60% maximum moisture content)

- Place the mixed and conditioned feedstock into one of the bunkers on the aeration floor after checking the aeration floor for plugs and air flow.
- Cover the mix with finished compost, wood chips, or other insulation material. This insulation material will also act as a biocover layer scrubbing odors, as the aeration system pushes the air in a positive direction.
- Adjust timer settings on the fan / zone dampers to adjust temperature in the pile
  - If too hot, increase the air flow to cool the pile.
  - If too cool, reduce airflow to allow heat up to occur.
- Monitor and record temperature daily with a hand held probe (or an automated probe) to ensure pathogen reduction temperatures and vector attraction reduction temperatures are met. These regulations are covered in the BC OMRR Schedules 1 and 2 (link here). With the right mix, the proper materials, and adjustment of the blower control system we have high confidence that these temperatures can be achieved in the O2 Compost System.
  - Pathogen destruction: 3 days at 55C or higher in an ASP.
  - Vector attraction reduction: 14 days at >40C with an average of 45C.
- Compost can be left for 20-40 days. If removed after 20 days due to excessive dryness (<40%), it should be re-wet and replaced in the bin for another 20 days.
- After 40 days on aeration, the compost can be cured in small windrows or piles (max 15' wide and 4' high) for final stabilization and maturation.
- The material should be sampled (protocols in Schedule 5) for pathogens (according to Schedule 3) and metals (Schedule 4) in order to ensure compliance with BC OMRR.
- With passing results on all schedules, the material can be considered a finished product, and the material should be screened to remove inert contaminants. A small trommel screen can be built and operated by one person with a hand shovel.
- The screened material should be sent for final testing for inert contamination. Schedule 4 of the BC OMRR requires that foreign matter be <1% of dry weight and the finished compost should have no sharp matter such as metal or glass of a size that can cause injury (in California anything below 4mm is not counted). We do not envision any problems with these regulations given the very small number of users providing feedstock.
- The material should be black, stable, of earthy non offensive odor, and should have reasonably high nutrient content making it an attractive soil amendment. The overs from screening can be used as top cover on subsequent batches of compost.
- Final material could be bagged by staff and provided to CT owners or others as compost. The survey identified a demand for the material. Cost recovery for bagged material is expected to be similar to that for the material produced by the CVRD Biosolids facility currently.

For information on the CVRD compost material refer to:

https://www.comoxvalleyrd.ca/services/waste-recycling-compost/skyrocket-compost/availability-rates

Operating costs (2019 cost)

- Blower fan (1hp): running continuously may consume 1kw/hr. With electricity cost of $0.13/kwh the annual cost of the fan is estimated at $1,140/yr.

- The operation of this facility could consume 0.1 to 0.2 of a FTE. With the total burdened cost of a skilled operator estimated at $75,000 per year, the labor cost to run a composting facility could be $7,500 - $15,000/yr.
- Repairs and maintenance could be estimate at 5% of the capital constructed cost for an estimated cost of 5%*$100,000 equaling $5,000/yr.
- Total operating costs are estimated at $14,000 to $21,000 not including land costs, loader or vehicle operation and maintenance costs which are presumed to be covered by other aspects of CVRD operations. This cost does not include depreciation of the facility infrastructure.

F- 9 ADDRESSING COMMUNITY CONCERNS

The survey data demonstrates concerns related to contamination of aquifer and watershed, odors and cost to tax payers.

The option considered addresses these concerns in the following manner:

- Odor control would be achieved by capping compost piles with biocover (a layer of organic material as a biological filter for odor).
- The compost piles would be contained in bunkers with a concrete floor with leachate drains. This would avoid leachate flow to the environment.
- Leachate would be re used in the process, avoiding the need for treatment and discharge systems for leachate. This would avoid the need for discharge of leachate to the environment. A roof covered ASP evaporates many times more water than it generates in leachate. GORE systems provide very low aeration rates and have been known to not provide enough drying, resulting in the need for leachate management. O2 Compost aeration supply rates are many times higher than GORE systems.
- The piles and curing material would be covered with roofs, avoiding risk of rainwater leaching nutrients from the compost and flowing to the environment.
- We recommend cost recovery on a user pay basis for operating costs, and consider that the per person year cost is affordable and sustainable (see below).

As a general note, it is our opinion that central composting of CT residual organic matter in a facility such as that described in this report is likely to significantly reduce risk of impact of nutrients and pathogens on groundwater. This is because the facility will be facilitating the diversion of the majority of nutrients and a major proportion of pathogens in human waste from sites which might otherwise have marginal sewerage systems.

We note that, if rezoning is necessary, the rezoning process would include significant community engagement.

G. Alternative option for central collection and off island composting

Feasibility for this option has been considered on the following basis:

- Central collection location (for feasibility assumed to be at the same central location considered for composting) with 12 yard sealed, roll off bin
- CT owners to bring material to the central bin and discharge to the bin, using compostable kraft paper bags as discussed above (or materials are picked up with a pick up service)
- Bin monitored by existing CVRD staff at the Hornby facility, and trucked by CVRD contractor's trucks when near full.

- Received at CVRD facility in Cumberland and combined with existing biosolids stream for composting. This would require approval from and an agreement with the Comox Valley Sewage Commission. A tipping fee may be levied on received material.
- Produced compost would form part of the existing production of "Skyrocket" compost distributed by the CVRD
- Odor control during hot weather may require fan forced ventilation of the bin to a biofilter or carbon filter system

This option may be considered for long term operation; however, it may also be suitable for interim or transitional operation as implementation of a central composting facility on Hornby is further assessed.

CVRD staff indicate a reluctance to accept bags, but we recommend consideration of the kraft paper bags which are not expected to cause issues with the composting process. They also noted the requirement that any collected co compost material be clean wood waste only. We note that chipped yard waste or leaves might be helpful given the nature of the CT residuals.

Cost analysis was based on information provided by CVRD staff, using their data from the cost of receiving other biosolids and trucking costs for other solid wastes from Hornby. Costs are based on 2019 pricing and do not include testing costs.

- Collection bin cost of $85/month for bin "rental"
- Odor control cost, unknown at present, a contingency of $180 to $300 per month has been allocated for this item—based on the addition of clean wood waste capping and potential fan forced ventilation to a carbon filter for odor control.
- Additional labor for monitoring of collection, for initial operation considered to be included in current operations but may become a consideration. A contingency of $300/month has been allocated for this item.
- Transport costs, estimated to be maximum $500 per 12 yard bin, lower cost may be obtainable.
- Tipping/receiving costs, estimated to be $100/tonne

Based on these costs and the estimated 85 cum/60 t of waste at the full future projection, plus any added wood waste capping, annual costs would be in the order of $15,000 to $20,000 per annum. For initial operation, costs would be expected to be at or below the low of range value.

Increased trucking and ferry costs are expected in the future, this may result in a disproportionate annual increase in cost for this option—since much of the cost is related to trucking and ferry fees. As there is no reliable way to quantify the future cost of ferry fares and trucking on a 25 year basis we have, for this preliminary evaluation, utilized current cost basis.

Cost for materials and electrical installation for the fan forced ventilation system, if needed, would be the only capital cost.

As noted above, it is necessary to further confirm that the existing zoning at the HIWMC site is appropriate for waste transfer.

H. Comparison of options

H- 1 CAPITAL COSTS

The collection and hauling option has very low to no capital cost as long as rezoning is not required. The central composting option is capital intensive.

Based on capital consideration only, the collection and hauling option is more favorable.

H- 2 OPERATION COSTS AND ONGOING FACILITY COSTS

Operation costs are similar for both options in 2019 dollars at full capacity.

The central composting option may incur increased ongoing costs depending on the method for sourcing a loader for use at the facility. Given the initial facility cost, over time there will be costs for maintenance and upgrade of the physical structures.

The collection and hauling option may incur increased ongoing costs due to disproportionate increases in cost of trucking and ferry fees. However, for initial operation the cost per user are expected to be lower, and more directly linked to number of users. The risk of disproportionate increase in cost is higher for the collection and hauling option.

If co composting is used at a central facility, cost savings for off island transport of other organic wastes are expected.

H- 3 COST RECOVERY

Given the small volume of material we do not consider cost recovery from sale of compost to be a significant factor.

Cost recovery is likely to be best approached at least partially via user fees. Based on an operating cost of $20,000 and 450 full time equivalent users, cost per user year would be in the order of $45. For the smaller number of users during initial operation, for central composting on Hornby, cost per user will be higher, for example with 150 users and a $15,000/year operational cost then cost per user would be in the order of $100. These fees would most easily be connected on a fee for drop off, or fee per bag, in a similar manner to the fees users are accustomed to for drop off of garbage. This could be managed by tags, charges for the required unique bags or other method as preferred.

This cost is relatively low, comparable to that for pump out of septic tanks for typical households based on an annualized per capita comparison for the future projection, higher for initial use. If the option of collecting and hauling is selected for initial operation, this is likely to reduce cost per user for initial operation as operation cost will be more directly related to volume. Some capital cost recovery may be practical through user fees, but we recommend not driving user fees to levels significantly above the same order of magnitude as those for septic tank pump out.

We understand that capital cost would also need to be recovered. This could be partially or wholly by grant funding, and it will be necessary to consider whether cost recovery from the community would be from the community as a whole or only from users of the facility. As this is not clear at this stage, we have not included recovery of capital costs in the above user fee estimate. If larger commercial users wish to discharge residuals to the facility, then one off capital cost recovery could be considered for any expansion needed to handle the larger volumes.

H- 4 OTHER FACTORS

We consider that several other factors affect choice of option for long term operation. These include:

- Additional composting infrastructure investments planned
- Community wishes
- Community concerns
- Sustainability objectives

- Decentralized reliance objectives
- Regulatory approvals
- Timeline
- Risk related to uptake

Table H- 1. Comparison table for central options

FACTOR	ON ISLAND COLLECTION AND COMPOSTING	ON ISLAND COLLECTION & TRANSPORT TO CVRD BIOSOLIDS FACILITY
Capital costs	Higher cost	Very low cost
Operating costs (current & projected)	Similar cost	Similar cost
Cost recovery options for capital and operating costs	Similar	Similar
Cost to users for operating costs	Similar	Similar
Community wishes	Likely to better reflect community opinion, due to greater sustainability.	Support to CT systems still provided, reflects community opinion.
Community concerns	Greater concerns, concerns readily addressed by design and operation, except for capital cost concerns.	Lesser concerns, may provide for phased introduction of on island facility
Sustainability objectives	More sustainable	Less sustainable, and vulnerable to increased transportation costs.
Decentralized reliance objectives	More supportive	Less supportive, unless as an initial phase
Regulatory considerations	Longer approvals period needed	Short approvals period anticipated
HIWMC usage, zoning	Necessitates rezoning of site	Rezoning may not be necessary
Risk related to uptake	High risk	Low risk
Other advantages		Suitable as a first phase even where central composting is planned. If used as a first phase would provide information to inform design of a central composting facility for CT residuals.
Compatibility with other waste diversion activities (co-composting, backhaul, etc.)	Some co composting may be practical, and may provide a small reduction in operating costs. Supply of wood wastes from off island by backhaul improves efficiency.	No significant impacts, although may be some potential synergy with any on island septage management strategies.

I. Conclusion and recommendations

We conclude that on island central collection and composting of CT residual organic matter is technically feasible. If the CVRD is willing to fund the capital cost for the facility, from the Hornby Island tax base and or from capital grants, then operating costs are likely to be supportable on a user pay basis but cost per user may be higher where uptake is not yet closer to system capacity. This option would take time to implement, with the need for regulatory approvals, funding and construction. Further, immediate implementation of this option is not practical, as a detail design phase would be needed, and if the HIWMC site is used rezoning would be needed. Risks associated with estimates of uptake and volume estimates exist.

We conclude that central collection and off island composting of CT residual organic matter is technically feasible. This option does not require significant capital investment. Operating costs are likely to be supportable on a user pay basis, including during initial operation (with a smaller user base). Regulatory approvals are not necessary unless the Islands Trust decides rezoning is needed for the collection site—which would impact existing waste management operations at the facility in any case. This option could be implemented in a very short time span (subject to approval by the Comox Valley Sewage Commission and assuming rezoning is not pursued), and due to the small capital investment, risk is very low.

Both options can address community concerns expressed in the survey, and both result in effective re use of waste resources. The on island composting option is more sustainable in the longer term, the off island option may be more achievable and more attractive in the short term.

Key advantages of either central collection or central collection and processing include the reduction in potential impacts from non compliant compost processing systems or disposal of CT residuals at the homes currently using CTs, and the support to adoption of composting toilet systems on Hornby—with resulting reduction in water demand and issues with marginal sewerage systems.

Considering these and other factors we recommend that the CVRD explore in the short-term implementation of central collection and off island composting.

During operation of this service, reliable data on volumes, material quality and uptake should be collected and used to support future conversion of the service to on island composting using a simple process such as the one we selected for this study. We consider that this approach would greatly reduce risks associated with implementation, and would avoid long delays in implementation. To support this approach, we recommend that the CVRD include funding for this monitoring process.

We also recommend that the CVRD implement, on Hornby and possibly in other communities, a program of educational outreach related to the operation of composting toilet systems and the safe discharge of residual organic matter. This program could be combined with the existing sewerage system educational outreach provided by CVRD.

Please do not hesitate to contact us for clarification.

Ian Ralston

Geoff Hill

Laura Busheikin

Claire Remington

Attached:

Survey and survey data (provided electronically only)

Islands Trust staff email with respect to zoning (provided electronically only).

STATEMENT OF GENERAL CONDITIONS

Scope of this Report

This review report satisfies only those objectives stated in the introduction. TRAX Developments Ltd. (TRAX) has not conducted a Site Investigation, Hydrogeology Study or Environmental Impact Assessment.

Use of this Report

This TRAX Developments Ltd. (TRAX) report pertains only to a specific project. If the project is modified, then our client will allow us to confirm that the report is still valid. We prepared this report only for the benefit of our Client and those agencies authorized by law to regulate our Client's activities. No others may use any part of this report without our written consent. To understand the content of this report, the reader must refer to the entire, signed report. We cannot be responsible for the consequences of anyone using only a part of the report, or referring only to a draft report. This report reflects our best judgement based on information available at the time. Any use of this report, or reliance on this report, by a third party is the responsibility of that third party. We accept no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based on this report.

Reliance on Provided Information

TRAX has relied on the accuracy and completeness of information provided by its client and by other professionals. We are not responsible for any deficiency in this document that results from a deficiency in this information.

Logs of Test Holes and Subsurface Interpretations

Ground and ground water conditions always vary across a site and vary with time. Test hole and well logs show subsurface conditions only at the locations of the test hole or well.

Descriptions of Geological Materials and Water Wells

This report includes descriptions of natural geological materials, including soil, rock, and ground water. TRAX based these descriptions on observations at the time of the study. Unless otherwise noted, we based the report's conclusions and recommendations on these observed conditions. Construction activities on the site or adjacent sites may change or alter these geological materials.

Changed Conditions

Conditions encountered by others at this site may differ significantly from what we encountered, either due to natural variability of subsurface conditions or construction activities. Our client will inform us about any such changes, and will give us an opportunity to review our recommendations. Recognizing changed soil and rock conditions, or changed well conditions, requires experience. Therefore, during construction or remediation, a ROWP or qualified professional should be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Recommendations

We recommend that our client engage TRAX to review all design drawings and constructed works that are based on our conclusions

Risks and Liability

TRAX carries commercial general liability insurance to an amount of $2M.

TRAX and Ian Ralston carry insurance for errors and omissions in the amount of $1M. In all cases the liability of TRAX and/or Ian Ralston is limited to the fees charged. By accepting and using this report the client accepts that TRAX and Ian Ralston's liability are limited in this way and acknowledges that they understand the insurance coverage carried.

Engineering Limited License scope

Ian Ralston holds a License from APEGBC to practice engineering within the following scope of practice:

Civil Engineering. Limited to: Design, construction and maintenance of sewage systems, including site and soil evaluations for these systems. Systems of 22.7 cubic meters per day or less.