Organic Waste Quantities and Characteristics

PREPARED FOR: Columbia Shuswap Regional District

PREPARED BY: CH2M HILL

DATE: August 12, 2013

VERSION: Final

PROJECT NUMBER: 475040

1 Introduction

The Columbia Shuswap Regional District (CSRD) has been working with the communities of Golden, Revelstoke, and Salmon Arm to investigate the potential for developing a source separated organic (SSO) waste collection and composting program to complement existing yard and wood waste diversion programs.

CH2M HILL was retained by CSRD to provide technical assistance with respect to this feasibility assessment. This technical memorandum summaries the results of an assessment of feedstock quantities, and forms the basis for subsequent analyses of collection and processing options.

2 Food Waste and Food-soiled Paper

Food waste makes up a significant proportion of the municipal solid waste stream. It is generated primarily by the residential and ICI sectors, and can be either 'post-consumer', originating in residential and commercial kitchens (i.e. restaurants, hospitals etc.), or 'pre-consumer', coming from distribution and retail agents (i.e. transporters, supermarkets). Food wastes typically have a high moisture content and a high nutrient content.

The following are examples of specific food wastes that are typically included in diversion programs:

- fruits and vegetables
- table scraps and plate scrapings
- meat, chicken, fish, and bones
- dairy products
- bread and baked goods
- coffee grounds/filters and tea bags
- pasta and rice
- eggs and egg shells
- paper towels, napkins and tissues
- soiled newsprint
- paper take-out trays and egg cartons

Food-soiled paper products are often included within the scope of food waste diversion programs. Food-soiled paper products (e.g., paper towels, napkins, pizza boxes, soiled or waxed cardboard, soiled newspaper, and tissues) cannot be recycled. However, these materials do not normally have any harmful or toxic characteristics and are readily degradable. Including food-soiled paper in collection programs is also beneficial from the perspective that it acts as an absorbent for free-liquids during collection.

2.1 Food Waste and Food-soiled Paper Quantities

The amount of food waste and food-soiled paper available in the residential waste stream can be estimated using detailed data from solid waste composition studies together with waste generation data. However, estimates based on this approach can be influenced by the level of detail of the waste component categories, the time of year that the sampling was done, and the number of samples obtained. Using this approach to determine the amount of material that can be diverted through collection programs also requires that participation and capture rates be estimated.

An alternative approach for estimating quantities of food waste is to rely on operating data from collection programs in other jurisdictions. Specifically, the "per household" diversion rate (e.g. kg/household per year) from existing programs can be combined with population statistics from the subject community to arrive at quantity estimates. This approach has the advantage that participation and capture rate estimates are not required as they are accounted for in the operating data. However, the drawback to this approach is that differences in education programs, accompanying policies and diversion incentives (e.g. pay-as-you-throw, disposal bans), consumer habits and climates are not factored in.

The latter approach has been used to estimate the amount of food waste that could be diverted in the three communities considered in this assessment.

Exhibit 1 provides collection statistics from programs where a relatively small green bin (60-80 litre) is provided for food and other kitchen waste (and perhaps small quantities of yard waste). Exhibit 1 also summarizes collection statistics from programs that co-collect food waste and yard waste together in the same container.

The data shows that the Ontario average and Nanaimo green bin diversion ranged between 115-148 kg/SFHH per year. In most communities, green bin collection is offered to some, but not all multi-family households as well. Thus, the actual food waste diversion per SFHH is probably somewhere between the two range endpoints. The average total organics (food plus yard waste) reported by the Ontario communities ranges from 223-285 kg/SFHH per year. The Ontario communities all use user-provided bags or cans for yard waste for part of the year on a weekly or every-other-week basis.

EXHIBIT 1
Organics Collection Data from Other Communities

	Yard Waste, Other	Food	Total Organics
Separate Food Collection, with HH-provided YW container			
Ontario Average[a] (kg/SF HH)	137	148	285
Ontario Average[a] (kg/All HH)	107	116	223
Nanaimo[b]	n.a.	115	n.a.
Combined Food/Yard Collection in Cart (kg/SFHH, food/YW split estimated)			
St. Albert, Ab[c]	249	120	369
Port Coquitlam, BC[d]	351	138	489
Metro Vancouver, BC[e]	n.a.	n.a.	434
Seattle, WA - 2 years of food/yard[d,f]	315	131	446
Tacoma, WA Pilot[d]	326	112	438

[a]Average of 7 largest Ontario communities in 2010. Excludes Toronto, which allows diapers. From: http://www.wdo.ca/content/?path=page82+item35931

[b]http://www.beyondcomposting.ca/faq.asp

[c]Based on time series data provided to CH2M HILL. Food assumed to be February organics collection.

[d]Port Coquitlam and Seattle estimated by comparing to period prior to food waste introduction; Tacoma pilot estimated by comparing to control collection routes with yard waste only.

[e]Email from Marcel Pitre, Metro Vancouver, May 14, 2012.

[f]Various reports available at http://www.seattle.gov/util/Services/index.asp.

Future changes in food waste quantities are affected by a number of factorings including population demographics and growth, tourism, and changes in an area's industrial base. A detailed assessment of these factors and their impact on solid waste quantities is beyond the scope of this assignment. However, a simplistic assessment of "waste growth" can be completed by using the per household waste generation rates in combination with projections of population and households.

Preliminary estimates of future residential food waste quantities from the three communities that were arrived at using this method is provided in Exhibit 2.

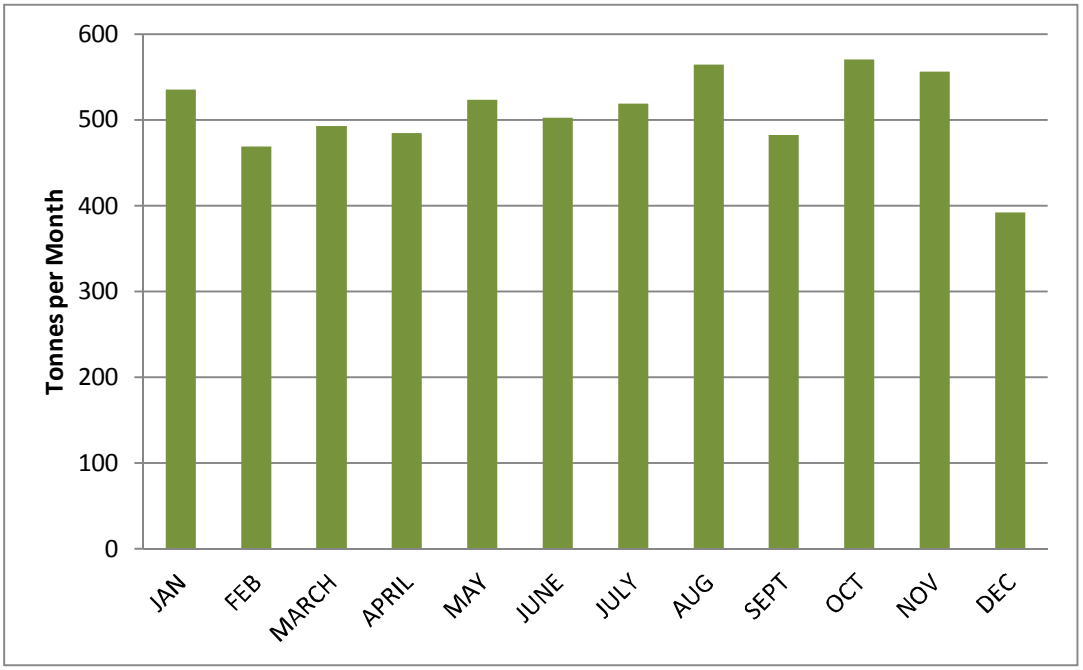
EXHIBIT 2
Estimated Average Annual Food Waste Quantities (tonnes per year)

Location	2012	2017	2022	2027
Golden	197	218	240	265
Revelstoke	336	371	409	452
Salmon Arm	822	907	1,002	1,106
Total	1,355	1,496	1,651	1,823

2.2 Seasonal Variation

The food waste component of the residential solid waste stream is significantly less variable than the L&YW stream. This is evident from the following graphical summary of monthly food waste quantities collected through the Regional District of Nanaimo's Green Bin program in 2012. Data from the residential food waste collection program in the Region of Peel exhibits a similar trend.

EXHIBIT 3
Seasonal Variations in Nanaimo Food Waste Quantities (2012)



Based on the data from the Regional District of Nanaimo, a conservative estimate of the peaking factor for food waste would be 1.15.

3 Leaf and Yard Waste

Leaf and yard waste (L&YW) is the term used to refer to a wide range of materials including grass clippings, leaves, flowers, weeds, pine needles and cones, and small prunings from bushes and trees. In some jurisdictions, Christmas trees from diversion programs operated in late December and January are also included in this category. L&YW is theoretically small enough that it does not require pre-processing (i.e. grinding) before inclusion in composting programs.

3.1 L&YW Quantities

Existing L&YW diversion program in the three communities resulted in the diversion of approximately 3,500 tonnes of material in 2012. A summary of the diverted quantities by community is provided in the following table.

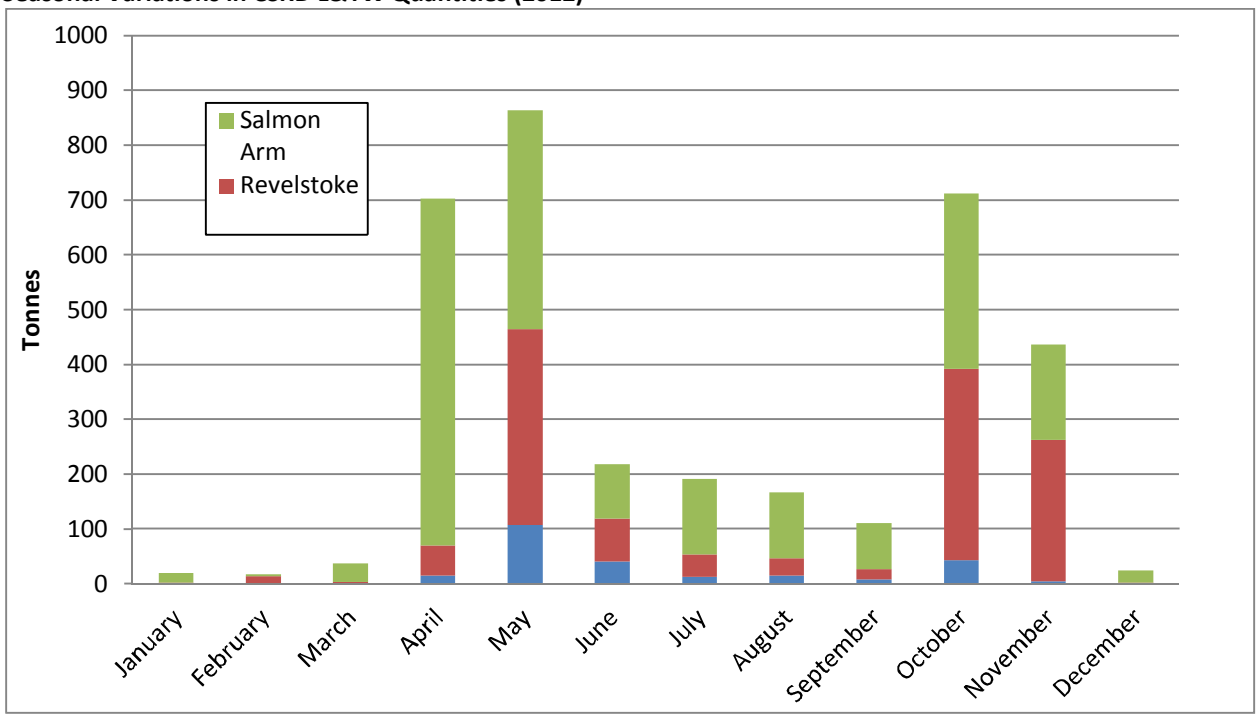
EXHIBIT 3
L&YW Waste Diversion (tonnes per year)

Location	2012
Golden	247
Revelstoke	1,207
Salmon Arm	2,042
Total	3,496

As part of the development of a composting facility, it is necessary to also consider the variability in generation rates of feedstocks over the course of the year. In particular, the variation in L&YW generation must be understood as there is the potential for quantities to vary substantially between the spring, summer and fall seasons.

Using landfill scale data provided by CSRD, the following graphical summary of month-by-month quantities of L&YW was prepared by CH2M HILL.

EXHIBIT 4
Seasonal Variations in CSRD L&YW Quantities (2012)



3.2 Factors Affecting L&YW Quantities

L&YW generation rates vary over the course of the year more than most other components of the municipal solid waste stream. L&YW quantities can also vary from year to year within the same area. Intuitively, these variations can be attributed mainly to climatic variations which directly affect the growth rate of grass and trees. The primary factors would be variations in temperatures, precipitation, and hours of sunlight.

Climatic variations are offset somewhat in urban settings by irrigation and fertilization practices. For example, the effects of a dry summer season on residential lawns can be offset by watering on a regular basis.

The age of residential and commercial developments, and the resulting maturity of trees used in landscaping, can lead to great variations in L&YW quantities within a municipality. For example, the amount of leaves generated by 50 to 75 year old trees in older neighborhoods is significantly greater than the quantities in newer subdivisions where trees are less than 10 years old.

Similarly, the amount and type of "green space" in a particular community will also affect the amount of L&YW attributed to municipal operations. There is generally less green space in smaller or older communities which are developed on a "grid pattern" of street, than in newer communities which are typically developed with non-grid road networks, neighborhood trail systems, de-centralized schools, and more park areas.

Snowfall can also impact L&YW quantities, since snowfall contributes to soil moisture which affects growing conditions during the following season. Snowfall can also affect quantities in a less obvious manner. For example, an early snowfall can disrupt leaf collection activities and force it to be deferred to the following spring. This will have the effect of reducing annual quantities in one year, and increasing it in the next. The delay can also increase seasonal peaks and affect a composting facility's processing capabilities.

Spring snow storms and other major storm events can also increase L&YW quantities. When snow storms happen late in the spring after trees have leafed out, there can be significant breakage of tree limbs from the weight of the snow.

Tree diseases (such as Dutch elm disease), insect infestations, and the need for pruning and other control measures, can also affect the amount of L&YW generated. L&YW debris resulting from control of these diseases/infestations is sometimes managed outside of diversion programs for other L&YW due to concerns over the spread of diseases.

Finally, there are a series of factors that affect the amount of generated L&YW material that is collected from residents and delivered to a composting facility including:

- **Financial incentives for diversion:** there is considerable research showing that pay-as-you-through (PAYT) programs increase diversion compared to flat fee or tax-funded programs[1].
- **Bans and other legislation:** Diversion can be increased by banning organics from disposal; organics collection can be decreased by banning grass from disposal.

[1] See, for example, http://www.epa.gov/epawaste/conserve/tools/payt/index.htm.

- **Education and promotion:** Strong messaging can help influence behaviour.
- **Container type:** The size and type of container can affect diversion. Large, wheeled bins typically result in more diversion than smaller bins or customer-supplied bins or bags that must be lifted and placed at the curb.
- **Collection frequency:** More frequent collection of organics and/or less frequent collection of garbage supports increased diversion.

4 Wood Waste

Wood waste is a significant component of the solid waste stream. For the purposes of this assessment, wood wastes are categorized into two groups: "green wood" and "white wood".

Green wood consists of prunings, brush, limbs, trunks and stumps. It is usually generated as a result of land clearing and development activities, but also from gardening and landscaping, and clearing of overhead utility lines. Significant quantities of green waste can also be generated by wind and ice storms. This material has already been addressed as "leaf and yard waste" in Section 3.3.

White wood consists of dimensional lumber and other "processed" wood products. It is often further broken down into "clean" (i.e. unpainted, untreated) and "unclean" (i.e. treated or painted). White wood is generally generated by construction, renovation and demolition projects activities, but can also include discarded furniture and shipping pallets. One log home manufacturer in the Penticton area generates approximately 50 tonnes per year of wood waste.

Diseased wood is a special sub-category of the wood waste stream that is unique to some jurisdictions. In areas of BC's interior, impacts on forests from the spread Mountain Pine Beetle are the primary concern.

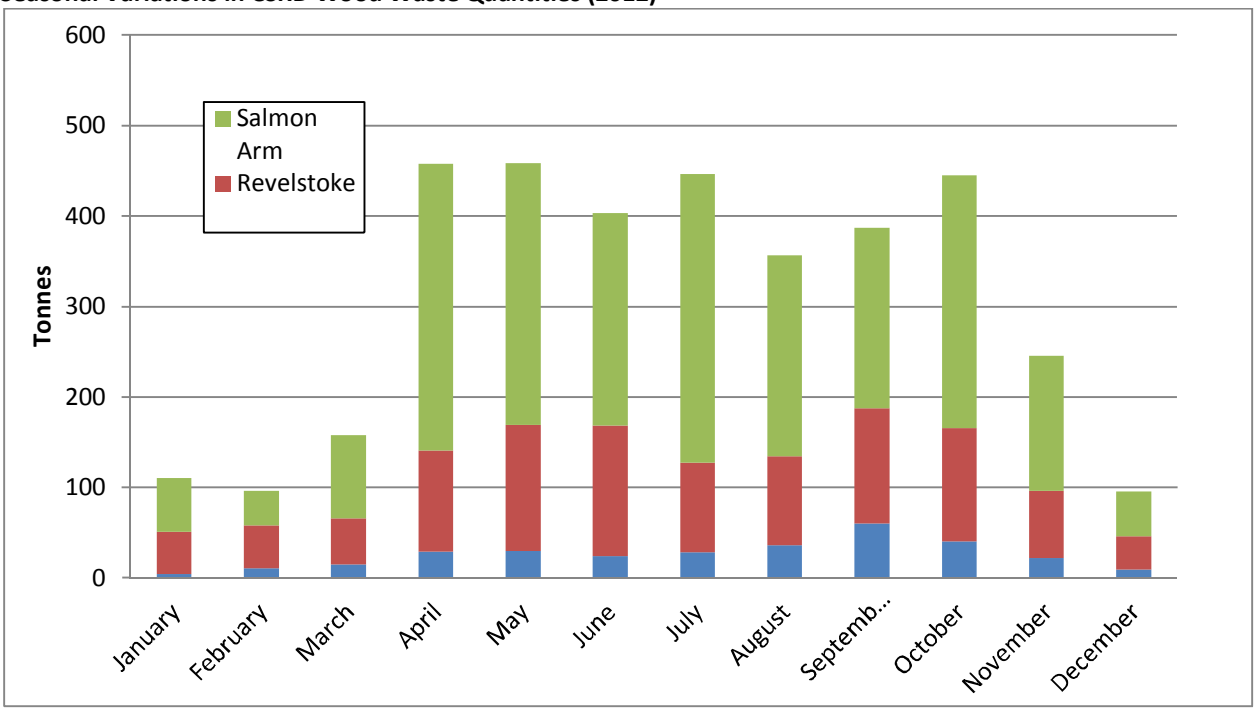
Existing wood waste diversion programs in the three communities result in the diversion of approximately 3,700 tonnes of material in 2012. A summary of the diverted quantities by community is provided in the following table. Using landfill scale data provided by CSRD, A graphical summary of month-by-month quantities of wood waste are provided in Exhibit 6.

EXHIBIT 5
Wood Waste Diversion (tonnes per year)

Location	2012
Golden	311
Revelstoke	1,103
Salmon Arm	2,247
Total	3,660

EXHIBIT 6

Seasonal Variations in CSRD Wood Waste Quantities (2012)



Understanding wood waste quantities is important as these materials are one of the most commonly used amendments in the composting process. Amendments are materials added to the organic waste(s) during the composting process to adjust the moisture content and/or carbon to nitrogen ratio into the desired range, and to provide structure and porosity to the mixture to improve the movement of oxygen. While the necessary adjustments can often be achieved through the use of one amendment type, it is not uncommon to mix two or more amendments with the organic wastes to achieve the desired results.

Wood chips produced through diversion and grinding of untreated dimensional lumber and logs/stumps/brush are the most commonly used amendment. Grass, leaves and brush from L&YW diversion programs can also be used, but the characteristics of these materials vary over the growing season which can lead to operational challenges. Cardboard (including wax-coated cardboard), sawdust, and straw are also commonly used, but are often less desirable.

It is also normal practice to recycle a portion of the oversized material screened from the finished compost back into the initial mixture of feedstocks. In addition to inoculating the bacterial population, these "overs" help adjust moisture levels and nutrient ratios. The amount of overs recycled back into the mixture depends on a number of factors and can vary through the year.