

PROJECT MEASUREMENT – CARBON CREDIT CALCULATIONS CITY OF RICHMOND ORGANIC WASTE DIVERSION (WASTE DROP-OFF SERVICE)

The carbon credit calculations completed for the 2007–2013 calendar years for the City of Richmond (the City) are presented in the following sections. The credit factors used and assumptions applied are also discussed in this document.

This report was produced by Keystone Environmental Limited (Keystone Environmental) for the purposes of verifying BC Provincial Option 2 carbon credits for use by the City of Richmond.

1. METHODOLOGY AND FORMULAS

The City of Richmond Organic Waste Diversion project uses calculated carbon credit factors applied to raw tonnage data obtained from the appropriate facilities, in order to calculate carbon credits derived from organics waste diversion.

$$\text{Carbon Credits (tonnes CO}_2\text{e)} = \text{Organics Diverted from Landfill (tonnes waste)} \times \text{Carbon Credit Factor (tonnes CO}_2\text{e/tonnes waste)}$$

Tonnage data was obtained directly from the City of Richmond. Data gathering and storage methodology is further discussed in Section 1.3 below.

The baseline year selected for this carbon credit project was 2006, as it is the calendar year prior to the signing of the 2007 Climate Action Charter. Baseline organics tonnage was obtained directly from the City of Richmond, similarly to the tonnage of organics diverted from 2007 to 2013.

The carbon credit factors applied to the project were determined using the spreadsheet provided in the BC Climate Action Toolkit website (<http://www.toolkit.bc.ca/carbon-neutral-government>). The spreadsheet is for the “Option 1D: Project Profile Household Organic Waste Composting” spreadsheet, the following inputs are required to determine carbon credit factors in tonnes of CO₂e:

- Kitchen scrap to yard waste ratio
- Project Type
- Landfill gas collection efficiency
- Landfill Location

For this project, the following table contains the information inputted into the spreadsheet:

Table 1 Option 1D: Organic Waste Composting input parameters

Input Parameter	Selected Quantity	Rationale
Kitchen scrap to yard waste ratio	1:1	Based on similar assumption made for regional Metro Vancouver carbon credit calculations.
Starting year	2007	Selected based on the first calendar year following the signing of the BC Climate Action Charter. The City of Richmond has opted to redeem credits for 2007 to 2013 calendar years.
Project type	Forced Aeration Compost (optimized)	Composting facilities used by City of Richmond are categorized as a “Forced Aeration Compost – Optimized,” following the regional Metro Vancouver approach.
Landfill gas collection efficiency	2007 - 50% 2008 - 37% 2009 - 39% 2010 - 47% 2011 - 38% 2012 - 58% 2013 - 60%	Landfill gas collection efficiency was obtained from Metro Vancouver’s <i>Municipal Organic Waste Diversion and Composting in Metro Vancouver: 2012 Reporting Year</i> report, provided by the City of Richmond.
Landfill location	Vancouver	The City of Richmond has confirmed that 100% of the City’s waste is processed at the Vancouver Landfill Facility.

2. DATA GATHERING AND STORAGE

The carbon credits were determined using raw tonnage data provided by the City of Richmond. Data is collected from both the City of Richmond Recycling Depot (Depot) and Ecowaste Industries Ltd. (Ecowaste), both located in Richmond, BC. These facilities collect organic yard waste through a drop-off system as a part of the City’s “no-cost disposal service” for organics from single and multi-family residential properties.

At the Depot, the facility receives organic waste and stores it on site in four 40 cubic yard bins. The bins are managed by BFI Canada and are removed several times a week to an external company for use as biofuel or compost. BFI provides monthly invoices to the City based on the tonnage removed. The City performs an internal check on the invoices to ensure the charges are reasonable. The invoices are stored in the City’s data base for a minimum of seven years.

At Ecowaste, yard waste is typically dropped off by City of Richmond residents. Starting in August 2013, commercial haulers hauling yard waste within the City and registered with Ecowaste have also been able to drop off yard waste at no charge. The yard waste is stored in a designated area of the site. A portion of the waste is sent to an external company for soil production, and the remainder is used on site for composting. Ecowaste uses a tonnage-based

system for composting (as opposed to a volume-based system) and weight records are generated using truck scales, calculating the net quantity of organic waste received at each facility each day. Daily summary sheets are generated and reviewed by the Ecowaste manager. Monthly invoices, after being reviewed by Ecowaste administration staff, are sent to the City of Richmond for their records and payment. The truck scale used on site is calibrated annually by Pacific Industrial Scale and certified by Measurement Canada. Records are stored in the Ecowaste's data base for duration of seven years.

3. CALCULATION METHODOLOGY AND EXAMPLE

The following example calculation for 2009 shows how the carbon credits were calculated using the raw tonnage data and calculated carbon credit factors:

1. **Carbon Credit Factor** (tonnes CO₂e/tonnes waste)
 - = see input data above
 - = 0.63 CO₂e/tonne for 2009

2. **Organics Diverted from Landfill** (tonnes)
 - = \sum [Monthly quantity to Ecowaste (tonnes) + Monthly quantity to Depot (tonnes)]
 - = 7522.5 tonnes + 1479.09 tonnes
 - = 9001.59 tonnes for 2009

3. **Eligible Organics** (tonnes)
 - = **Diverted Organics** (tonnes) - **Baseline Organics Diverted in 2006** (tonnes)
 - = 9001.59 tonnes - 4709.12 tonnes
 - = 4292.47 tonnes for 2009

4. **Carbon Credits** (tonnes CO₂e)
 - = **Organics Diverted from Landfill** (tonnes waste) x **Carbon Credit Factor**
(tonnes CO₂e/tonnes waste)
 - = 0.63 CO₂e/tonne x 4292.47 tonnes
 - = 2709.03 tonnes CO₂e for 2009

Similar equations were used to determine the carbon credits for 2007, 2008, 2010, 2011, 2012, and 2013. If the diverted organic is less than the amount of the 2006 baseline year, the eligible organic will be zero for that year.

4. TOTAL WASTE ORGANIC DIVERTED AND CALCULATED CARBON CREDITS ACHIEVED

Tables 2 summarizes the organic waste diverted landfill based on actual waste collected and the eligible organics calculated. Table 3 summarizes the calculated carbon credit factors using the provincial methodology from the spreadsheet entitled "Option 1D: Project Profile Household Organic Waste Composting" and the carbon credits calculated.

Table 2 Tonnage of total organic waste diverted/eligible

Year	Organic Waste Diverted (tonnes)	Eligible Organic Waste (above 2006 baseline - tonnes)
2006	4,709	-
2007	5,694	259
2008	7,067	2,358
2009	9,002	4,292
2010	4,664	0
2011	2,384	0
2012	2,102	0
2013	2,276	0

Table 3 Calculated carbon credits in tonnes of CO₂e

Year	Carbon Credit Factor (tonnes CO ₂ e/tonnes waste –based Option 1D Project Profile Household Organic Waste Composting)	Carbon Credits Eligible Organic Waste x Conversion factor (tonnes CO ₂ e)
2007	0.71	182.97
2008	0.68	1,614.65
2009	0.63	2,709.03
2010	0.58	0
2011	0.53	0
2012	0.46	0
2013	0.43	0
Total Credits Achieved		4,506.65

5. LIMITATIONS

Findings presented in this report are based upon (i) a review of available records, correspondence, and invoices, (ii) interviews with available personnel familiar with waste drop-off activities, and (iii) a limited visual review of accessible areas of the on-site operations, processes, and data management methods. Consequently, while findings and conclusions documented in this report have been prepared in a manner consistent with that level of care and skill normally exercised by other members of the environmental science and engineering profession practicing under similar circumstances in the area at the time of the performance of the work, this report is not intended nor is it able to provide a totally comprehensive review of past or present site environmental conditions.

This report has been prepared solely for the internal use of the City of Richmond, pursuant to the agreement between Keystone Environmental Ltd. and the City of Richmond. By using this report, the City of Richmond agrees that they will review and use the report in its entirety. Any use which other parties make of this report, or any reliance on or decisions made based on it, are the responsibility of such parties. Keystone Environmental Ltd. accepts no responsibility for damages, if any, suffered by other parties as a result of decisions made or actions based on this report.

Keystone Environmental Ltd.

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Date

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