

Waste Data Independent Review

November 2023

Submitted by:

Paul van der Werf, PhD
Adjunct Professor in the Department of Geography and Ivey Business School,
Western University

Table of Contents

About the Independent Auditor.....	3
Executive Summary	1
1.0 Introduction	1
2.0 Background and Context.....	1
3.0 Independent Review Objectives and Scope	1
3.1 Independent Review Approach and Methodology	2
4.0 Independent Review Observations.....	3
4.1 2018-2019 Four Season Curbside Waste Audit Study Report.....	3
4.2 The Corporation of the City of Ottawa 2019 Solid Non-Hazardous Multi-Residential Waste Audit.....	4
4.3 The Corporation of the City of Ottawa 2019 Facility Operations Waste Audit.....	6
4.4 Long Term Waste Management Needs Report-projections	7
4.5 Landfill Projections.....	12
5.0 Conclusions and Recommendations	14

About the Independent Auditor

Paul van der Werf is an adjunct professor at Western University's Department of Geography and the Ivey Business School. Paul is a recognized waste management expert with more than 30 years of national and international professional experience. He combines considerable hands-on experience with data analysis skills. Paul's key areas of expertise include waste management data collection, analysis and modelling, and specialized waste diversion expertise in the areas of organic and recyclables management.

Paul holds an undergraduate degree in Environmental Biology from the University of Guelph as well as a Masters degree in Science (compost utilization). Paul completed his PhD at Western University, specializing in household food waste reduction.

Executive Summary

This independent review was conducted in response to Councillor Motion (2023-16-06) brought forward on June 14, 2023, directing Staff to undertake an independent third-party review to verify data being used to inform the development of the City's draft Solid Waste Master Plan.

The objective of this independent review was to verify if:

- All City-provided data to inform the SWMP's technical documents were complete and calculated in-line with municipal best practices;
- All assumptions made in the SWMP's technical documents are reasonable to support the project team's recommendations;
- The methodologies used to interpret the data are appropriate for the purposes of informing a SWMP; and,
- All data and conclusions are accurate.

To meet the objectives, the independent review included the following activities to assess the appropriateness of the methodologies used for data collection, verify the accuracy of results, compare results to other jurisdictions (as applicable), and identify any data gaps:

- Interview of City staff from the Solid Waste Services branch in Public Works, and staff from external consulting firms including HDR Inc. and Dillon Consulting;
- Reviews of relevant documentation, as outlined in Section 4 of this document, including the 2018-2019 Four Season Curbside Waste Audit Study Report' (single-family); The Corporation of the City of Ottawa 2019 Solid Non-Hazardous Multi-Residential Waste Audit'; 'The Corporation of the City of Ottawa 2019 Facility Operations Waste Audit' 'June 2021 Long-Term Waste Management Needs' report; and 'System impacts and graphs'- City of Ottawa Excel file; and
- Data from other municipalities through sources including the Resource Productivity and Recovery Authority (RPRA) Data Call.

In general, the City collected and used data that met municipal standards and are reasonable to use in developing waste generation, disposal and diversion projections used for the SWMP process. The City should compare actual waste generation with these

projections to understand how well or not they align (and then adjust as necessary). Further, since the baseline used for SWMP projections is 2019; which is quite reasonable and avoids and Covid impacts on waste generation, they should be updated for future program planning. All the supporting studies (i.e., waste audits) should be updated and strengthened (i.e., by increasing sample sizes). Finally, the City should undertake a detailed update of waste projections at least every five years

This independent auditor found that the data and documents used as part of the SWMP process appear appropriate, reasonable, and in line with industry best using qualified waste management consultants to help collect this data. This includes long-term waste projections and the impact of garbage disposal on the life-cycle of the Trail Waste Facility Landfill.

This report makes several recommendations which focus on keeping City data up-to-date and in some cases strengthening the representativeness of this data:

- Update Single-Family Waste Audits and consider adding more households;
- Update Multi-Residential Waste Audits and ensure it is expanded to four seasons. Also consider expanding the number of buildings in this waste audit.
- Update City Facilities Waste Audits and use this process to develop an average waste generation, disposal and diversion estimate for all City facilities.
- Update the Parks Waste Audit to better understand waste generation and composition.
- Refine landfill cover usage and update projected landfill airspace usage, if necessary;
- In general, compare actual waste generation, by waste stream, annually; and
- Undertake a detailed update of waste projections at least every five years

1.0 Introduction

City Staff initiated an invitational Request for Proposal (RFP) from external, qualified consultants with direct experience in the waste management field to undertake a detailed and independent review of the data that City staff is using to inform shorter term policy and program recommendations, as well as longer term planning initiatives being considered through the development of the Solid Waste Master Plan (SWMP or “SWMP”).

The City required that the consultant compile a comprehensive report that can be delivered to Council in advance of the draft SWMP.

This report summarizes the review of documentation and data developed by the City of Ottawa for the SWMP.

2.0 Background and Context

The City of Ottawa is in the process of developing a new SWMP that will guide how the City manages waste over the next 30 years. Staff is in the third phase of the SWMP’s development and will be tabling the draft Solid Waste Master Plan for Committee and Council for receipt in Q4 2023. The Final SWMP will be tabled for Council approval at the end of Q2 2024.

On June 14, 2023, Ottawa’s City Council brought forward a motion directing Staff to undertake an independent third-party review to verify data being used to inform the development of the City’s draft Solid Waste Master Plan.

3.0 Independent Review Objectives and Scope

The objective of this independent review was to verify if:

- All City-provided data to inform the SWMP’s technical documents were complete and calculated in-line with municipal best practices;
- All assumptions made in the SWMP’s technical documents are reasonable to support the project team’s recommendations;
- The methodologies used to interpret the data are appropriate for the purposes of informing a SWMP; and,
- All data and conclusions are accurate.

The scope of this independent review included an assessment of all data collection methods, audit methodologies, projection development and analysis used by the City in the development of its draft SWMP to determine if it is in-line with municipal best practices and that it can be relied on for both long-term planning purposes and shorter-term initiatives. Data provided to the City by third party consultants was assessed to determine if it is reasonable to be used for program planning, based on available industry insight and data. This included some Quality Assurance (QA) and Quality Control (QC) reviews of the work done by other consultants who collected data on behalf of the City. All information received by this independent reviewer was reviewed to identify gaps and/or potential concerns and recommendations were provided for future City projects to consider.

The independent review was conducted between September 6 and September 26, 2023.

3.1 Independent Review Approach and Methodology

The independent review provides an assessment as to whether the current information, data, modelling, assumptions, framework, and projections are reliable and defensible to support decision making for both short-term initiatives and long-term strategy planning.

This report deals specifically with the data used to support the development of the City's draft Solid Waste Master Plan. A subsequent report detailing the findings of the independent review of the CDO data will be provided to the City in Q4 2023.

The independent review methodology included the following activities:

- Interview of City staff from the Solid Waste Services branch in Public Works, and staff from external consulting firms including HDR Inc. and Dillon Consulting;
- Reviews of relevant documentation, as outlined in Section 4 of this document, including the 2018-2019 Four Season Curbside Waste Audit Study Report' (single-family); The Corporation of the City of Ottawa 2019 Solid Non-Hazardous Multi-Residential Waste Audit'; 'The Corporation of the City of Ottawa 2019 Facility Operations Waste Audit' 'June 2021 Long-Term Waste Management Needs' report; and 'System impacts and graphs'- City of Ottawa Excel file; and
- Data from other municipalities through sources including the Resource Productivity and Recovery Authority (RPRA) Data Call.

The following process, as applicable, was followed:

- Assess the appropriateness of the **methodologies** use for data collection;
- Verify **accuracy** of results;
- **Compare** results to other jurisdictions (as applicable); and,
- Identify any **data gaps**.

Any identified gaps in the data analysis and methodologies were recorded and described in the report. For any gaps the following was undertaken:

1. Indicate whether gaps impede or bring-into question, the nature/basis of the work completed or if the data can still support the decisions being made even with any gaps. It is of utmost importance for City staff to understand that even with any potential gaps, the work completed is good to support policy recommendations, strategy planning and shorter-term initiatives.
2. Provide any necessary recommendations to the City for how to improve data collection/analysis and outline any, if any, best practices that were missed.

4.0 Independent Review Observations

4.1 2018-2019 Four Season Curbside Waste Audit Study Report

The '2018-2019 Four Season Curbside Waste Audit Study Report' (Single-Family Waste Audit) was used to create a baseline of single-family household garbage and waste diversion stream generation and composition as well as participation in waste diversion programs.

Single-family waste generation was used to help inform a baseline that was used for SWMP projections. Detailed composition data was used to help better understand divertible waste materials (e.g. recyclables, organics) in the garbage stream, which in turn helped identify further waste diversion opportunities.

Review of Methodology

An established, sound and municipal best practice methodology was used to collect this data. The methodology used to conduct the Four-Season Curbside Waste Audit Study was developed over the last twenty years by Stewardship Ontario (SO) and the Continuous Improvement Fund (CIF), primarily to better understand the capture rate of recyclables.

This Single-Family Waste Audit entailed the curbside collection and detailed examination of garbage and waste diversion streams from ten groups of 10 consecutive households. These ten groups of households were selected, by City Staff, to be representative of City single-family households. These households were studied for two consecutive week periods in Fall 2018 and Winter, Spring, Summer 2019. A standardized list of waste materials (e.g., recyclables, garbage) was assessed. Municipalities, including Ottawa, routinely add additional waste material categories (e.g., organics). This methodology is widely used by municipalities throughout Ontario (and other jurisdictions).

Overall garbage quantity and composition data, from this Single-Family Waste Audit, was used to help estimate the amount of different waste types (e.g., black bin, blue bin, green bin) in the single-family garbage stream, up to 2052.

Assessment of Accuracy

The data was reviewed, and samples the report's data tables were checked for accuracy. The data checked appeared to be accurate.

Comparison to Other Jurisdictions

As noted above this waste audit methodology is widely used by Ontario municipalities.

Data Gaps

The Single-Family Waste Audit study was thorough. The data from the Single-Family Waste Audit Study was used by HDR Inc. to develop single-family household waste generation projections (as documented in the June 2021 Long-Term Waste Management Needs technical memorandum). The waste projections used 2019 as a base year.

This data is now four years old, and it is recommended that this Single-Family Waste Audit be updated to confirm post-Covid waste generation and composition. The City should consider working with a professional waste auditing firm to expand the number of households that are included in the next Single-Family Waste Audit to improve the representativeness of this data collection.

4.2 The Corporation of the City of Ottawa 2019 Solid Non-Hazardous Multi-Residential Waste Audit

'The Corporation of the City of Ottawa 2019 Solid Non-Hazardous Multi-Residential Waste Audit' report (Multi-Residential Waste Audit) was used to create a baseline of multi-

residential household garbage and waste diversion stream generation and composition as well as participation in waste diversion programs.

Multi-residential waste generation was used to help inform a baseline that was used for SWMP projections. Detailed composition data was used to help better understand divertible waste materials (e.g., recyclables, organics) in the garbage stream, which in turn helped identify further waste diversion opportunities.

Review of Methodology

The methodology used to collect this data generally followed a methodology developed by SO and CIF. This methodology was developed over the last twenty years, primarily to better understand the capture rate of recyclables. This waste audit took place over one season. Multi-residential waste audits are typically completed over four seasons to measure any seasonal impacts on waste generation.

This Multi-Residential Waste Audit entailed the detailed examination of garbage and waste diversion streams from five buildings. These five buildings were selected, by City Staff, to be representative of City multi-residential households. These households were studied over a one-week period in in Fall 2019. Generally, this type of study would be repeated over four seasons. A standardized list of waste materials (e.g., recyclables, garbage) was assessed. Municipalities routinely, including Ottawa, add additional waste material categories (e.g., organics). This methodology is widely used by municipalities throughout Ontario (and other jurisdictions).

Overall garbage generation and composition data, from this Multi-Residential Waste Audit, was used to help estimate the amount of different waste types (e.g., black bin, blue bin, green bin) in the multi-residential garbage stream up to 2052.

Assessment of Accuracy

The data was reviewed, and samples the report's data tables were checked for accuracy. The data checked appeared to be accurate.

Comparison to Other Jurisdictions

As noted above this waste audit methodology is widely used by Ontario municipalities.

Data Gaps

The Multi-Residential Waste Audit study was thorough, although it only examined one season. Data was used to help with multi-residential household waste generation projections, which used 2019 as a base year.

This data is now four years old, and it is recommended that this Multi-Residential Waste Audit be updated to confirm post-Covid waste generation and composition. Further, the City should consider conducting Multi-Residential Waste Audit over four seasons because this is the industry standard. They should consider working with a professional waste auditing firm to expand the number of buildings that are included (up to 10) and expanding to a full two-week data collection cycle to improve the representativeness of this data collection.

4.3 The Corporation of the City of Ottawa 2019 Facility Operations Waste Audit

'The Corporation of the City of Ottawa 2019 Facility Operations Waste Audit' (Facility Waste Audits) was used to create a baseline of City of Ottawa Facilities garbage and waste diversion stream generation and composition.

Review of Methodology

The methodology used to collect this data generally followed the approach to comply with Ontario Regulation 102/94 'Waste Audits and Waste Reduction Workplans' (i.e., facility size thresholds to complete waste audits and waste reduction workplans) and 103/94 'Industrial Commercial and Institutional Source Separation Programs' (i.e., facility size thresholds for source separation programs).

This Facility Waste Audits entailed the detailed examination of garbage and waste diversion streams from 12 facilities. These 12 facilities were selected, by Ottawa, to be representative of the City's various facilities. These facilities were studied from 17-20 December 2019. The report mentions that these buildings were also studied in February 2020 but these results do not appear to be included in the report. A standard list of waste materials (e.g., recyclables, garbage), similar to those used for residential waste audits, were assessed.

Overall garbage generation and composition data, from this Facility Waste Audit, was used to help estimate the amount of different waste types (e.g., black bin, blue bin, green bin) in the multi-residential garbage stream up to 2052.

Assessment of Accuracy

The data was reviewed, and samples the report's data tables were checked for accuracy. The data checked appeared to be accurate.

Comparison to Other Jurisdictions

Not applicable.

Data Gaps

The Facility Waste Audit study was thorough and appeared to include a reasonably representative set of City facilities.

This data is now four years old and it is recommended that this Waste Audit be updated to confirm post-Covid waste generation and composition. This should include an estimate of the overall waste composition from City Facilities.

4.4 Long Term Waste Management Needs Report-projections

The June 2021 Long Term Waste Management Needs Report, prepared for the City by HDR Inc. (HDR), was reviewed along with files that detailed waste projections and calculations. HDR's statistician was also interviewed (14 September 2023) to better understand how projections were developed.

Review of Methodology

The consultant HDR modelled and projected Ottawa residential waste generation from 2020-2052. The City's 2019 waste stream disposal and diversion information served as baseline data to inform the projections. The City's 2018-2019 Four Season Curbside Waste Audit Study and 2019 Multi-Residential Waste audit was also used to provide insight into waste composition.

Firstly, the 2019 waste data were allocated by HDR and the City by generator type (i.e., single-family, multi-residential, multi-residential commercial garbage, City facilities and Parks).

Secondly, HDR assessed The City of Ottawa's 2010-2019 Ottawa waste generation data (Table 12 of the June 2021 Long-Term Waste Management Needs, reproduced below) and noted that single-family per household waste generation has been declining while multi-residential household waste generation has fluctuated but has held steady. The consultant noted, based on industry observations, that single-family data, in particular,

reflect changes in the waste stream brought on by changes including how media is consumed (e.g., reduction in newspaper) and light-weighting of packaging.

Table 12: Historical City of Ottawa Curbside and Multi-residential/Containerized Total and Per Household Waste Tonnage (2010-2019)

Year	Curbside Residential Tonnes	Curbside Residential Households	Curbside Residential Tonnes/ Household	Multi-Residential / Containerized Tonnes	Multi-Residential / Containerized Households	Multi-Residential / Containerized Tonnes/ Household
2010	281,749	269,428	1.05	48,509	92,059	0.53
2011	283,690	269,151	1.05	48,143	91,767	0.52
2012	279,796	275,680	1.01	49,282	93,487	0.53
2013	273,522	276,506	0.99	52,781	97,639	0.54
2014	274,987	279,471	0.98	55,654	99,625	0.56
2015	274,034	282,125	0.97	56,537	103,894	0.54
2016	264,849	284,840	0.93	57,129	106,068	0.54
2017	277,583	287,555	0.97	59,861	108,242	0.55
2018	272,696	290,269	0.94	59,698	110,416	0.54
2019	277,804	292,984	0.95	60,148	112,590	0.53

(reproduced from the June 2021 Long-Term Waste Management Needs report)

On this basis HDR determined that using projected household numbers alone were insufficient in developing meaningful projections. The addition of socio-economic indicators could assist in developing more realistic projections.

HDR undertook a detailed statistical linear regression analysis of 2010-2019 City waste data to help understand the best predictor(s) of waste generation. This included examining a wide range of socio-economic indicators.

The resultant statistical analysis revealed that lagged (1 year) employment data was the best (and statistically significant) predictor of residential waste generation and better than using household numbers alone, for projection purposes.

HDR then used the results of this statistical analysis to project residential waste generation from 2020-2052.

The methodology that HDR developed and used is reasonable and well thought out and a good approach to project future waste generation.

The 2019 baseline tonnage data, as provided to HDR by the City, appeared to be accurate. HDR's application of its model appeared to be accurate.

Importantly the data used are all pre-Covid and a reasonable starting point for projections.

Assessment of Accuracy

Single-family and multi-residential garbage, bulky waste, blue bin and black bin waste projections were compared to actual weights using 2020, 2021 and 2022 data (i.e., the first three years of data projection).

Table 4.1 depicts single-family curbside garbage and includes bulky waste and the allocated portion of City Facilities. On average actual garbage was underestimated by 2.3%.

Table 4.1 Single Family Garbage

Year	Single Family Garbage-Projected	Single Family Garbage-Actual	+/- %
2020	136,797	145,877	-6.2
2021	136,588	138,946	-1.7
2022	136,208	134,741	1.1
Average			-2.3

Table 4.2 depicts multi-residential garbage and bulky waste. The amount of garbage is underestimated by about 11%. The amount of bulky waste is considerably overestimated but is a relatively small contributor to overall tonnages.

Table 4.2 Multi-Residential Garbage and Bulky Waste

Year	Multi-Residential Garbage - Projected	Multi-Residential Garbage-Actual	+/- %	Multi-Residential Bulky Waste - Projected	Multi-Residential Bulky Waste-Actual	+/- %
2020	50,263	45,974	9.3	6,805	1,863	265.3
2021	50,256	45,207	11.2	6,761	2,879	134.8
2022	50,246	44,867	12.0	6,720	2,707	148.2
Average			10.8			182.8

Table 4.3 depicts single-family blue bin and black bin materials. The amount of blue bin material is underestimated by about 10%. The amount of black bin material is underestimated by about 7%.

Table 4.3 Single-Family Blue Bin and Black Bin (tonnes/year)

Year	Blue Bin - Projected	Blue Bin - Actual	+/- %	Black Bin - Projected	Black Bin - Actual	+/- %
2020	21,995	24,642	-10.7	30,185	32,748	-7.8
2021	21,963	24,788	-11.4	30,141	33,572	-10.2
2022	21,903	23,541	-7.0	30,059	31,000	-3.0
Average			-9.7			-7.0

Table 4.4 depicts multi-residential blue bin and black bin materials. The amount of blue bin material is underestimated by about 16%. The amount of black bin material is underestimated by about 6%.

Table 4.4 Multi-Residential Blue Bin and Black Bin (tonnes/year)

Year	Blue Bin - Projected	Blue Bin - Actual	+/- %	Black Bin - Projected	Black Bin - Actual	+/- %
2020	3,224	3,795	-15.0	5,918	6,113	-3.2
2021	3,203	3,869	-17.2	5,880	6,361	-7.6
2022	3,184	3,763	-15.4	5,846	6,208	-5.8
Average			-15.9			-5.5

In general, the projected versus actual comparisons are reasonable. As well, these comparisons take place largely during the pandemic where the impact of the pandemic on the municipal waste stream is well-documented.¹ Single-family garbage and black/blue bin projections are underestimated (all <10%). Multi-residential garbage projections are overestimated by 11% and black/blue bin projections are underestimated by up to 16%. The additional single-family garbage generated, and single-family and multi-residential blue/black bin materials captured from 2020-2022, (as compared to projections) may, in part, be a function of the pandemic and its impact on waste generation.

¹ <https://www.policyintegrity.ca/blog>

It is recommended that the City monitor projections versus actuals every year and fully update projections at least every five years.

Comparison to Other Jurisdictions

A review of the methodology used for waste projections for the City of Ottawa was compared to the approach used by the City of Toronto in completing a similar exercise, as well as overall waste generation data from peer municipalities in Ontario.

A similar statistical approach was used by HDR to help project City of Toronto waste generation.² This analysis resulted in different socio-economic indicators being used than for Ottawa. This is to be expected given the different populations in these two cities. It also speaks to the potential precision of this approach rather than just using household growth over time to project waste generation.

The Resource Productivity and Recovery Authority (RPRA) collects and summarizes municipal residential disposal and diversion waste data annually. Data from the most recent available years (2018-2021) was analyzed.

This was done as an additional layer of analysis to compare Ottawa data provided to RPRA with data used to project landfill capacity and to compare Ottawa to its peers.

Ottawa appeared to use very similar data for RPRA and landfill projections.

Ottawa data was compared to the Regional Municipalities of Halton, York, Peel, Durham, Waterloo and Niagara; the Cities of Toronto, London, Hamilton; the Essex-Windsor Solid Waste Authority; and the County of Simcoe.

Waste generation (disposal + diversion) is summarized in Table 4.5. In general, Ottawa waste generation is slightly lower than peer municipalities. Overall waste disposal is about 10% higher and waste diversion about 20% lower than peer municipalities.

² Waste Projections and Composition Analysis Mixed Waste Processing Study Executive Summary
City of Toronto December 9, 2019 <https://www.toronto.ca/legdocs/mmis/2020/ie/bgrd/backgroundfile-146478.pdf>

Table 4.5 Waste Generation Comparison

	Generated kg/capita			
	2021	2020	2019	2018
Large Urban Regional				
HALTON, REGIONAL MUNICIPALITY OF	363	384	357	364
TORONTO, CITY OF	283	287	281	285
LONDON, CITY OF	384	394	388	383
YORK, REGIONAL MUNICIPALITY OF	331	338	316	318
HAMILTON, CITY OF	414	422	401	394
PEEL, REGIONAL MUNICIPALITY OF	368	365	361	362
Municipal Group Total	333	338	326	328
Urban Regional				
DURHAM, REGIONAL MUNICIPALITY OF	355	394	373	383
ESSEX-WINDSOR SOLID WASTE AUTHORITY	405	470	408	406
WATERLOO, REGIONAL MUNICIPALITY OF	332	333	331	327
SIMCOE, COUNTY OF	469	479	473	457
NIAGARA, REGIONAL MUNICIPALITY OF	451	436	421	421
OTTAWA, CITY OF	363	378	354	355
Municipal Group Total	382	401	380	380
As a percent of Urban Regional Group Total	95%	94%	93%	93%
As a percent of Urban Regional Group Total & Large Urban Regional Group Total	96%	97%	95%	96%

Data Gaps

There are no apparent data gaps.

The current estimates are based on 2010-2019 waste generation data. When 2020-2022 projections and actual waste generation was compared the results were reasonable. It would be useful to compare 2023 (at the end of the year) to see if there are any new waste generation trends potentially emerging.

The baseline (i.e., 2019) data is four years old and it is recommended that this data be updated. In general, the waste projections should be fully updated at least every five years.

4.5 Landfill Projections

Calculations were undertaken by the City and its consultants to estimate the tonnes of garbage that would be landfilled from 2020-2052.

Review of Methodology

The tonnages used for these projections were largely derived from the projections developed as part of the June 2021 Long-Term Waste Management Needs report (Appendix D) (reviewed in Section 4.4 of this report). This included single-family garbage and bulky waste; multi-residential garbage and bulky waste; and City facilities garbage. Parks data was derived from the City of Ottawa's Parks Pilot Waste Audit Study conducted in 2019-2020. Non-residential data, which is assumed to be industrial, commercial and institutional (IC&I) appears to have been derived directly from City of Ottawa data. It is projected, by the City, not to change from 2020-2052.

The amount of cover material added (25% by weight of incoming garbage) and emplacement density of garbage and daily cover (0.75 t/m³) was provided by the City of Ottawa.

Assessment of Accuracy

The numbers used for landfill waste projections were compared to the numbers in the June 2021 Long-Term Waste Management Needs report and appeared to be accurate.

It was estimated by the City, in its landfill capacity calculations, that the emplaced density of garbage and cover material is 0.75 t/m³. This is in line with various reports and literature that estimate a density range from 0.125-1.380 t/m³, with an average of 0.75 t/m³^{3 4 5 6}. For this size of landfill 0.75 t/m³ is conservative and therefore reasonable estimate.

The City estimates that for every tonne of garbage it receives it adds 25% of that weight as daily cover. It is not entirely clear how this was calculated. From 2017-2021 data, provided by the City this appears to be closer to 41%. From discussions with Dillon Consulting it is understood that the 41% value also includes cover required for interim/final cover projects.

³ Understanding Waste from a Climate Change Perspective: Municipal Solid Waste Management in Canada
https://www.umanitoba.ca/institutes/natural_resources/pdf/theses/Masters%20Thesis%20Bonam%202009.pdf

⁴ How do we measure and Landfill Measurement – Why & monitor landfills?
https://swananorthernlights.org/wp-content/uploads/2019/06/Steve-Johnson-Landfill-Measurement_.pdf

⁵ LANDFILL CRITERIA FOR MUNICIPAL SOLID WASTE
https://www2.gov.bc.ca/assets/gov/environment/waste-management/garbage/landfill_criteria.pdf

⁶ Essex-Windsor Regional Landfill 2012
<http://www.ewswa.org/wp-content/uploads/2013/05/2012-Regional-Landfill-Report.pdf>

Typical landfill cover addition is reported on a volume basis and a recommended 4 garbage to 1 part cover material is common.^{7 8} The Essex-Windsor Solid Waste Authority (EWSWA) used approximately 38% cover material at its landfill.⁹

Comparison to Other Jurisdictions

See Section 4.4, Comparison to Other Jurisdictions

Data Gaps

There is a potential material data gap related to the amount of landfill cover that is used. This may be greater than the 25% by weight used in City projection estimates. If this is the case this may marginally utilize landfill airspace more quickly than predicted.

5.0 Conclusions and Recommendations

Overall, the data and documents used as part of the SWMP process appear appropriate, reasonable, in line with industry best practices, and using qualified waste management consultants to help collect this data. This includes long-term waste projections and the impact of garbage disposal on the life-cycle of the Trail Road Landfill.

Recommendations are based on keeping City data up-to-date and in some cases strengthening the representativeness of this data.

Specifically, recommendations include:

- Update Single-Family Waste Audits and consider adding more households;
- Update Multi-Residential Waste Audits and ensure it is expanded to four seasons. Also consider expanding the number of buildings in this waste audit.
- Update City Facilities Waste Audits and use this process to develop an average waste generation, disposal and diversion estimate for all City facilities.
- Update Parks Waste Audit to better understand waste generation and composition.
- Refine landfill cover usage and update projected landfill airspace usage, if necessary; and

⁷ METHODOLOGY FOR DETERMINING REMAINING LANDFILL CAPACITY
<https://ndep.nv.gov/uploads/land-waste-solid-forms-docs/landfill-capacity-guidance.pdf>

⁸ Landfills for Disposal of Medical Waste
<https://www.malsparo.com/landfill.htm>

⁹ Essex-Windsor Regional Landfill 2012 <http://www.ewswa.org/wp-content/uploads/2013/05/2012-Regional-Landfill-Report.pdf>

- In general, compare actual waste generation, by waste stream, annually; and
- Undertake a detailed update of waste projections at least every five years

Disclaimer

In preparing this report, I relied, in whole or in part, on data and information provided by the City of Ottawa and third parties that was current at the time of such usage. I have worked to assess this data and to determine if it is well developed, accurate, and appropriate.

Therefore, while I have utilized my best efforts in preparing this report, I do not warrant or guarantee the conclusions set forth in this report which are dependent or based upon data, information or statements supplied by third parties or the client, or that the data and information have not changed since being provided in the report.