Waste Resource Strategy Update Document Review Report

May 2013

Mirror Nova Scotia

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Submitted by:

Dillon Consulting Limited

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Waste Resource Strategy Update, Document Review Report

Dillon Consulting Limited (Dillon) is pleased to submit our review of a document entitled *Waste Resource Strategy Update*, issued by Stantec Consulting Limited in January 2013 and subsequently posted on Halifax Regional Municipality's website.

We look forward to discussing your comments on this report.

Yours truly,

DILLON CONSULTING LIMITED

Original signed

Scott D. Kyle, P.Eng.
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Executive Summary

In January 2013, Stantec Consulting Limited (Stantec) issued a finalized version of their project report to HRM (entitled Waste Resource Strategy Update), with the document subsequently being posted on HRM's web page on February 5, 2013. Dillon Consulting Limited (Dillon) was subsequently retained by MIRROR NS, to conduct an evaluation of Stantec report, with a focus on; Section 3 – Otter Lake Waste Processing and Disposal Facility, Section 4 – Landfill Design and Section 5 – Opportunity to Create a Regional Waste Resource Campus.

Dillon's review of the Stantec document resulted in the identification of 13 issues of concern, requiring additional assessment, clarification and/or explanation. They are summarized as follows:

Front End Processing and Waste Stabilization Facility (FEP/WSF)

1. Incorrect definition of the intended role of the FEP/WSF.
2. Inconsistent characterization of the current quantities of recyclables and compostables that exist within the mixed waste stream.
3. Unsubstantiated conclusion regarding the acceptability of disposing hazardous waste materials at the RDF.
4. Failure to acknowledge the mixed load deterrent and segregated material educational benefits of the FEP.
5. Failure to acknowledge the substantial reduction in traditional landfill site nuisance concerns (e.g., birds, blowing litter) as a result of processing activities within the FEP/WSF.

Residuals Disposal Facility (RDF)

1. Lack of acknowledgment and understanding of the unique characteristics of the waste and cover material at the RDF.
2. Inaccurate representation of the landfill gas generation characteristics of a processed waste versus unprocessed/raw waste disposal site.
3. Selection of unrepresentative landfill sites as a basis for an analysis of RDF operating costs.
4. Failure to recognize the local and provincial community commitment implications of reducing the current RDF liner standard.
5. Failure to identify potential cost and operational implications of increasing the RDF design height.
6. Lack of acknowledgement of the integrated operational relationship of the FEP/WSF/RDF and the resulting benefits of local community acceptance, population growth and developer confidence.

Regional Waste Resource Management Campus

1. Lack of recognition of the importance of a decentralized facility development model in relation to the original objectives of the 1995 CSC Strategy.
2. Preparation of an unrealistic and unsubstantiated estimate of the schedule and development costs required to establish a regional waste resource campus.

On the key question of the current effectiveness of the FEP/WSF, Stantec, based on an inaccurate set of applicable performance criteria, conclude that "the FEP/WSF concept yields few benefits…" and recommend its closure by the end of 2013. Dillon's review of HRM's 1999 Agreement with the Halifax Waste Resource Society (HWRS) confirmed that the original commitment made by HRM to the host community was to ensure that no unprocessed waste would be placed in the RDF. With reference to the language contained in the 1999 Agreement, it is our opinion that FEP/WSF has consistently and effectively met that operational obligation and continues to do so.

Generally, the analysis presented in the Stantec document could be characterized as a preliminary "desktop" review with a very limited presentation of assumptions, estimation details and data sources. Particularly notable were the Canadian and American landfill sites selected for comparison to the Otter Lake RDF in terms of operational cost. Of the 11 sites brought forward for comparison in the Stantec document, five had "clay only" liner systems (which have not been permitted in NS for over 20 years) and five had incoming waste tonnages ranging from five to over 19 times the amount of material that is currently accepted at the Otter Lake RDF. These and other important details impacting the relevance of the sites brought forward for comparison are absent from the Stantec document.

Similarly, estimated costs for proposed facilities are presented in an unqualified manner and with very little supporting information. A primary example of this the capital cost estimate for a proposed regional waste resource campus provided in Section 5.5 of the Stantec report. In the absence of a conceptual facility layout, identification of any general site attributes (e.g., proximity to servicing, access to a highway network) or definition of a recommended contingency allowance, a capital cost estimate of $10 million is confidently provided.

Finally, the Stantec document presents an analysis with limited recognition of the social and political complexities associated with the development and implementation of a municipal waste management strategy. Issues such as previous community commitments (both locally and at the provincial level) and challenges associated with the siting of new waste management infrastructure are mentioned only in passing. Those who were involved in the long and contentious process to identify a waste resource management solution leading up to and following the closure of the Highway 101 Landfill site recognize the danger in this approach. If the establishment of a municipal solid waste program could be conducted in the absence of public involvement with a primary focus on technical matters and costs, it would certainly make the task much easier for system managers. But as residents of HRM know, definition, implementation and ongoing operation of a comprehensive, integrated waste management program, to be successful, must be completed through direct and meaningful engagement with system users and host community residents.

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1.0 Introduction

In July 2012, Halifax Regional Municipality (HRM) issued a Request for Proposals entitled No. P12-061- HRM Solid Waste Resource Strategy System Review, Performance Assessment and Options Analysis. Following a competitive bidding process, Stantec Consulting Limited (Stantec) was selected as the preferred consultant to complete the assignment. As stated in the introductory Notice section of the RFP document, the purpose of the study was to "provide a review, performance assessment, bench marking and options analysis for HRM's Solid Waste Resource Strategy and System…"

In January 2013, Stantec issued a finalized version of their project report to HRM (entitled Waste Resource Strategy Update), with the document subsequently being posted on HRM's web page on February 5, 2013.

In response to a request from MIRROR NS, the attached report provides an analysis of select components of the Stantec report, with a focus on the following sections of the document:

Section 3 – Otter Lake Waste Processing and Disposal Facility
Section 4 – Landfill Design
Section 5 – Opportunity to Create a Regional Waste Resource Campus

2.0 Otter Lake Waste Processing and Disposal Facility

2.1 Front End Processing and Waste Stabilization Facility

2.1.1 Operational Intent, Obligations and Documented Performance

A primary component of the Community Stakeholder Committee's (CSC) March 1995 document An Integrated Waste Resource Management Strategy for Halifax County/Halifax/ Dartmouth/Bedford was the provision of system components to "remove recoverable resources (recyclables and compostable materials)" as well as " hazardous wastes, putrescible and other materials that are banned from disposal" from the mixed residue stream. This was consistent with the CSC's stated objective that "no material is sent to residuals disposal (landfill) without processing." Referred to as Front End Processing Facilities for Mixed Residuals, they were identified as the "final checkpoint for materials that might otherwise be routed to the residuals disposal facilities".

Founded on the content of the CSC's March 1995 strategy document, Halifax County issued a request for proposals to establish a solid waste/resource system that would deliver the CSC strategy. In consultation with the CSC, and following the selection of MIRROR NS as the preferred private partner to establish the new solid waste/resource system, HRM (established on April 1, 1996) prepared and issued an updated version of the original strategy document in May 1996. Entitled the Revised Integrated Waste/Resource Management Strategy, it provided additional detail to CSC's original plan and maintained its key principles including "the disposal of only stabilized and inert materials at the RDF" (Residuals Disposal Facility).

In terms of key operational performance criteria for the FEP/WSF (ultimately designed, built, and operated by MIRROR NS), the Operations Plan that supports the Otter Lake Facility's current NSE Operating Approval specifies them as follows:

- Non-recyclable Inert Materials will be separated and disposed of in the RDF.
- Recyclable materials will be extracted and stored separately on the Site pending removal by MIRROR NS.
- Materials capable of being rendered into Stable Materials through biostabilization will be processed through the WSF.

- Hazardous Substances and other Prohibited Materials will be extracted and temporarily stored on the site pending removal by MIRROR NS through a contractor.
- The mechanically separated putrescible fraction from the FEP process was prepared for stabilisation by bringing the material to adequate moisture levels within a range of 50% to 65% nominal by weight.
- The controlled biostabilization process consisted of no less than 15 days.
- Temperatures were maintained in the optimum thermophilic temperature range of 55 degrees Celsius or greater for a minimum of three days.
- Temperature profiles throughout the entire enclosed process were controlled such that under normal operating conditions the maximum temperatures were maintained not to exceed 60 degrees Celsius.
- The material demonstrates moisture holding properties.

It is noted that the facility performance standards developed for the FEP/WSF made no reference to the quantity or value of materials diverted from the RDF.

Since the original commissioning of the FEP/WSF in 1999 and with reference to the criteria presented above, MIRROR NS has been obliged to provide monthly reports to HRM and NSE on actual facility performance results. After over 14 years of operation and reporting, neither HRM nor NSE has identified any significant issues of concern related to the performance of the Otter Lake facility.

2.1.2 Review of the Stantec Analysis

An Error in Definition

Within Section 3 of the Stantec report, an analysis of the effectiveness of the FEP/WSF is presented. Unfortunately, the analysis conducted by Stantec was founded on an incorrect definition of the finalized performance objectives for the FEP/WSF, namely “the removal of recyclables and compostables converted to a useful and valuable resource”. While this was a performance goal included in the CMC’s original March 1995 Strategy document, it was (as described in Section 2.1.1) subsequently revised in May 1996. The revised definition of the performance objectives of the FEP/WSF, established through consultations with HRM, the CMC and MIRROR NS, made no reference to the value of the materials diverted from disposal, but instead focused on achieving specific processing requirements associated with the organic fraction of the mixed waste stream prior to its delivery to the RDF. In fact, the Revised Annual

Cost Profile Assumptions presented in the May 1996 strategy explicitly define the updated role of the FEP/WSF; "Unlike the previous version, this facility will not generate revenue and related expenses through additional diversion. Its system role is limited to sorting inert material that can go directly to the RDF and stabilizing the remaining compostable material in the WSF." Thus, the idea that the processes conducted at the FEP were to provide a "return on investment" through the extraction of valuable recyclable commodities is erroneous and inconsistent with the actual performance objectives specified by HRM.

Conflicting Characterizations

Importantly, the basis for the recommendation to close the FEP/WSF does not appear to be based on fact. In terms of the ongoing necessity for the FEP/WSF, the Stantec analysis relies on the argument that as a result of the successful implementation of HRM's three stream program, the character of the mixed waste material in the black bag is significantly less contentious today (with regard to the Province's landfill bans) than when Otter Lake was originally commissioned. As stated in Section 3.2.1 of the Stantec document, "…the waste stream in 1995 contained large amounts of both recyclables and compostables which the FEP was intended to remove." One would expect that the tonnage being delivered to the FEP would have decreased significantly and that the composition of that tonnage would have little or any recyclable and compostable material. This does not appear to be the case.

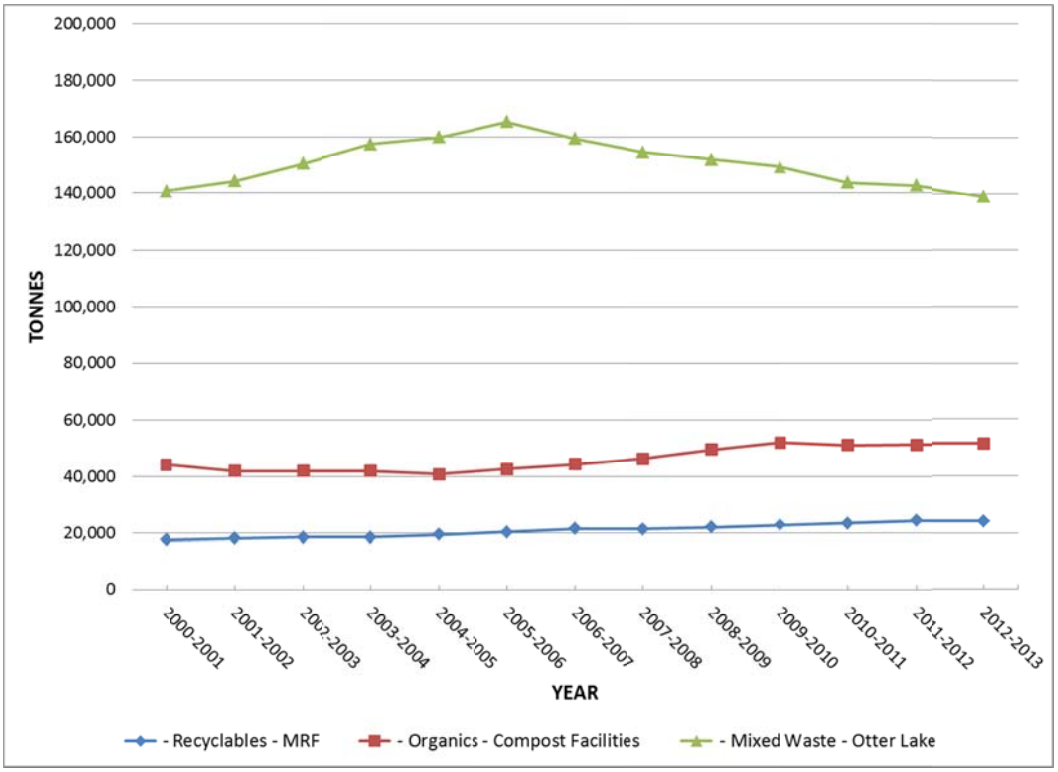
It is clear, from HRM data (see **Figure 2-1**), that the quantities of waste material arriving at the FEP, the Bayers Lake MRF and the two composting facilities have not changed significantly since original commissioning of these facilities.

In addition, evidence that the composition of the waste reaching the FEP still contains significant amounts of recyclable and compostable material is also found in recent HRM documents.

Using the first fiscal year of full implementation of HRM's integrated system (2000/01) as a starting point, Figure 2-1 presents incoming tonnage data for the FEP, the MRF and the two compositing operations up to the end of March 31, 2013. As illustrated in the figure, and looking at the start and end of the 13 year time period, the amount of material arriving annually at the Otter Lake FEP is almost unchanged. A decline after a noted FEP tonnage peak of 165,000 tonnes in 2005/06 could potentially be linked to enhanced efforts to divert C&D materials away from Otter Lake and toward licensed processing and disposal facilities within HRM. Figure 2-1

does present incremental improvements in the amount of material arriving at the MRF (6,700 tonne increase) and composting facilities (7,100 tonne increase) over the 13 years, the amounts are rather modest in comparison to overall system tonnages and do not indicate a significant change in the nature of HRM's municipal waste stream.

Figure 2-1 HRM Waste Management Facility Incoming Tonnage (FY 2001 – FY 2013)*



***Source:** HRM 2001/02 Operating Budget, HRM Waste/Resource System Mass Balance Reports (see References)

Further, Stantec's positive assessment of HRM's efforts to have residential and ICI generators segregate recyclables and organics from the mixed waste stream conflicts with findings presented by HRM staff to Council in 2010 and 2011. As summarized in a report dated November 25, 2010 and in support of a proposal to establish a clear bag program for mixed waste materials, staff contended that significant quantities of compostable organics and recyclables continued to arrive at the FEP within the mixed waste stream. With regard to the ICI waste stream, and founded on 2008/09 audit data, the November 2010 staff report contended that "50% of ICI waste arriving at the landfill should have been diverted". In March 2011, through a

presentation entitled *Increasing Diversion – By-law S-600,* HRM staff substantiated their position with a series of photographs from the FEP tipping floor presenting instances of mixed loads cross-contaminated with large quantities of organics and recyclables.

The lack of consistency between the Stantec assessment of the current state of the waste stream, HRM's published facility data and evidence provided in 2011 by HRM staff to support the establishment of a clear bag program requires additional analysis and resolution.

Acceptance of Hazardous Waste

With regard to the removal of hazardous waste materials from the mixed waste stream at the FEP, the Stantec report makes several subjective statements. In Section 3.2.1, Stantec's analysis contends that due to the availability of municipal household special waste programs and the fact that "household cleaning and lawn care products were far more toxic than today", the removal of all hazardous materials at the FEP was no longer worthwhile. With reference to the table on page 3.5 of the Stantec report presenting a list of hazardous materials recovered at the FEP in 2011, this leads to a question for Stantec; what quantity of regulated hazardous material would be considered *unacceptable* for delivery to the RDF? While the Province is clear on their requirements for the management of these materials (they are prohibited from disposal in municipal solid waste landfills – a complete list of banned materials is provided as **Appendix C**), Stantec appear to be offering a somewhat more relaxed interpretation of the regulations. A clarification from the Province and HRM appears to be in order.

The Deterrent Effect

A benefit of the FEP that is not mentioned in the Stantec analysis is its overall educational and deterrent ("gatekeeper") effect. For the five year period between 2008 and 2012, an annual average of 612 warnings and 40 load rejections (provided after multiple warnings) were issued at the FEP. In the instance of a rejection, the collector is obliged to remove the load and take it to a location for appropriate sorting; a time consuming and expensive requirement for a collection contractor. Not only does this lead to an improved waste diversion result (following resorting), but it creates a significant incentive for all collectors to educate their clients on proper waste source separation procedures. By eliminating the FEP's deterrent role, it seems quite likely that quantities of recyclables and compostable organics within the mixed waste stream, particularly from ICI generators, will increase. While some degree of post-discharge load review/rejection is

still be possible at a raw waste landfill site, the ability to efficiently cordon off, inspect and repack is significantly reduced in comparison to the FEP tipping floor.

Reduction in Birds and Blowing Litter

Another benefit of the FEP/WSF system absent from the Stantec analysis is the significant reduction in nuisance impacts at the disposal cell. The content of the CSC's original Integrated Waste/Resource Management Strategy was directly influenced by the legacy of the Highway 101 Landfill. As stated in the Executive Summary of that document; "The Highway 101 Landfill in Upper Sackville has damaged the local community and environment…We can no longer afford to make the same mistakes." The CSC's requirement for the FEP and WSF was founded on an objective to reduce the traditional impacts associated with raw waste landfills, including blowing litter and the attraction of birds. After over 14 years of operation, the processed material that arrives at the RDF has proven to be of limited interest to seagulls and crows. Ongoing litter management is required in active portions of the RDF, but at a reduced level of intensity as compared to a raw waste landfill. The orderly scene at the tipping face of the RDF stands in dramatic comparison to the clouds of gulls, paper and plastic bags that were typically encountered at Sackville's Highway 101 site and from other landfills where raw unprocessed organic material is disposed.

2.1.3 Noted Issues of Concern

In summary, noted issues of concern with Stantec's analysis of the benefit of the FEP/WSF are as follows:

1. Incorrect definition of the intended role of the FEP/WSF.
2. Inconsistent characterization of the current quantities of recyclables and compostables that exist within the mixed waste stream.
3. Unsubstantiated conclusion regarding the acceptability of disposing hazardous waste materials at the RDF.
4. Failure to acknowledge the mixed load deterrent and segregated material educational benefits of the FEP.
5. Failure to acknowledge the reduction in traditional landfill site nuisance concerns as a result of processing activities within the FEP/WSF.

2.2 Residuals Disposal Facility

2.2.1 Operational Intent, Obligations and Documented Performance

In response to growing public concerns about observed and potential environmental impacts of existing disposal facilities, and as part of an overall review of waste management legislation, the Province of Nova Scotia began efforts to develop more rigorous municipal solid waste landfill standards in the early 1990s. The effort, led by the Nova Scotia Department of Environment (now Nova Scotia Environment), was founded on the historic experience of the department, comments provided by community stakeholders and a review of best practices in other North American jurisdictions. As part of a review of a proposed design for a municipal solid waste landfill (Colchester Balefill Facility) near Kemptown, NS in 1992, NS Environment brought forward a requirement for liner system that incorporated the following components:

- A leachate collection layer to allow leachate to be collected and directed to a holding tank for future treatment.
- A single composite liner that would combine the features of a synthetic (e.g., high density polyethylene) liner and a natural low permeability soil liner.
- A leak detection layer to provide the ability to determine if the single composite liner was performing as designed and to collect any leakage should the liner system be compromised.

This requirement was subsequently incorporated into the design of the first disposal cell for the Kemptown site. In October 1997, the Province formally defined the composite liner requirement as well as other siting and design stipulations in a document entitled *Municipal Solid Waste Landfill Guidelines*.

Since the construction of the landfill cell at the Colchester Balefill Facility site in 1993, six additional new municipal solid waste landfills have been sited, approved, commissioned and expanded (phased development of additional disposal cells) consistent with the Province's composite liner standard:

1. Cumberland Central Landfill (Cumberland Joint Services Management Authority).
2. Otter Lake Waste Processing and Disposal Facility (Halifax Regional Municipality).
3. West Hants Landfill (Waste Management of Canada).
4. Kaizer Meadow Environmental Management Centre (Municipality of the District of Chester).

5. Region of Queens Waste Management Facility (Region of Queens Municipality).
6. Guysborough Waste Management Facility (Municipality of the District of Guysborough).

Dillon has been involved in the establishment of several of these facilities and can attest to the fact that the composite liner standard developed by the Province of Nova Scotia has served to address many of the groundwater impact issues that local residents and stakeholders typically highlight as a leading concern.

2.2.2 Review of Stantec Analysis

The RDF: Not a Raw Waste Site

Section 3.3.2 of the Stantec report presents an analysis of the in-place (landfilled) waste density at the RDF. As a basis of their analysis, Stantec make reference to typical in-place density results from raw waste landfills, including the Waterloo Waste Management Site. While the analysis concludes that reported density results at the RDF are satisfactory, the analysis fails to acknowledge the unique character of the material accepted for landfilling. At a typical raw waste landfill, such as the Waterloo site, waste arrives in an "as disposed" state; typically bagged waste and bulky debris (such as furniture and mattresses). Material used for daily cover is generally soil or in some instances a form of alternative cover. In the case of daily soil cover, the layer is typically removed at the beginning of each working day to optimize the use of the available airspace (volume) within the landfill.

In comparison, waste arriving at the RDF consists of the same bulky debris (approximately 30% by weight); with the remainder being shredded "over-sized" items from the FEP (approximately 53%) and processed material from the WSF (approximately 17%). A layer of ground C&D debris, consisting primarily of wood, flooring, vinyl siding and drywall, is placed over the waste as daily cover (as mandated by HRM). This cover layer remains intact and is not removed prior to waste placement on the following day of operation. While use of processed C&D material at the RDF helps bolster HRM's waste diversion statistics, it is a less than ideal landfill cover material as it allows precipitation to easily access the waste mass and for gas to readily escape. Typically, a cover layer of soil (although spray-on coatings and tarps are also sometimes used) would be selected to provide a less permeable, higher density and more efficient (in terms of the amount of landfill volume consumed) cover layer.

So while it is reassuring that the overall air space use efficiency (density) at the RDF is in keeping with results from traditional raw waste disposal sites, the unique character of both the waste and cover at the Otter Lake site warrants acknowledgment. It also highlights the requirement to use discretion when making comparisons of operating requirements at the RDF to traditional, raw waste disposal sites. This issue is discussed further later on in this section.

A Consistent Amount of Landfill Gas

In Section 3.2.3 of the Stantec document, the landfill gas generation characteristics of processed waste from the FEP/WSF are discussed. The analysis in this section provides the impression that the processed material creates increased odour and landfill gas generation concerns as compared to typical raw waste disposal sites. In fact, as a result of the organic stabilization benefit provided by the WSF, the total amount of landfill gas that can be generated from the overall waste mass is less than it would be if mixed waste was delivered directly to the RDF. While Stantec's assertion that processed material will generate gas more quickly due to its reduced particle size is correct, the illustrative generation curves presented on page 3.7 are an inaccurate and incomplete.

Gas generation within a landfill, whether the material is processed or unprocessed, does not follow a simple linear progression as presented in Stantec's graph. In fact, it follows a more complex "modified Bell curve" progression as approximated by the following first order decomposition equation (ref.: USEPA - Landfill Gas Emissions Model LandGEM Version 3.02 User's Guide):

$$Q_n = k \cdot L_0 \cdot \sum_{i=0}^{n} \sum_{j=0.0}^{0.9} \frac{M_i}{10} \cdot e^{-k \cdot t_{i,j}}$$

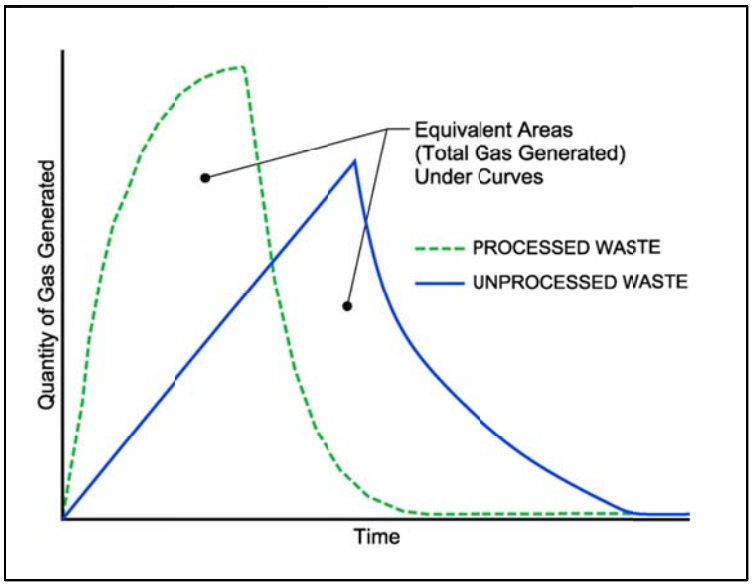
Where:

Q_n is the methane generation rate for a specific year (m^3 CH_4/year)
k is the first order decay rate constant (1/year)
Lo is total methane potential (m^3 CH_4/ton of waste)
M_i is the annual burial rate (tonnes)
t is time after original waste placement (years)
J is the deci-year time increment

Based on experience using the LANDGem model as well as field observations of gas system performance at Otter Lake and traditional MSW landfill sites, **Figure 2-2** presents a more

representative comparison of the landfill gas generation characteristics of a processed waste landfill (such as the RDF) and a typical raw/unprocessed waste site.

Figure 2-2 Typical LFG Generation



As illustrated in Figure 2-2, gas generation occurs more quickly in the instance of a processed waste landfill, but it also dwindles to a marginal value in a relatively short period of time. In comparison, gas generation at a traditional raw waste landfill reaches its peak later on and gas generation continues for a much longer period of time. So while the incomplete figure on page 3.7 of the Stantec report gives the impression that small particle size processed waste generates more gas than large particle size unprocessed waste, the fact is that the overall area under the curve (total amount of gas generated), assuming other characteristics of the waste are consistent, remains the same whether the material is processed or unprocessed. At a traditional raw waste landfill, however, landfill gas generation and its associated odour and safety issues extends over a much longer period, with active management being required as long twenty years after placement. In comparison, at Otter Lake, completed capped cells are typically removed from the landfill gas collection within six years of capping system due to a lack of generation. Residents in proximity to the Highway 101 Landfill can attest to the fact that odour issues can continue to be a significant concern many years after the closure of a raw waste site.

Questionable Comparisons

In terms of the total cost to construct and operate a disposal cell, Stantec attempts to make comparisons between calculated values for the Otter Lake RDF and a variety of sites from across Canada and the United States in Section 3.3.2 of their report. Stantec present reported 2010 and 2011 operating cost for six "similar" landfills in Canada, noting "landfill operations cost data is highly variable based on tonnage received which changes from year to year" Further, they note "municipalities have different methods of allocating capital and operating costs, administrative expenses and general municipal overhead." Both of these statements are true and illustrate the questionable value of attempting direct comparisons between reported operating costs at publically operated facilities. For reasons that are unclear, Stantec nevertheless present the data, with values ranging from $15 to $71/tonne. It is notable that none of the Canadian sites referenced by Stantec have a liner system as sophisticated as that required in Nova Scotia. In fact, all four of the cited Ontario jurisdictions rely on basic "clay-only" liner systems at their municipal solid waste landfills. Further discussion on a fifth Ontario disposal site (used by the Peel Region) referenced in the Stantec document is provided below.

While acknowledging the limited value of comparing reported per tonne landfilling costs for municipal solid waste landfills within Canada, the Stantec document suggests that more relevant examples of "all-inclusive cost of construction and operating landfills" can be found using published tip fee data for US sites. Tip fee values for four US states are presented, Michigan ($41/ton), Maine ($84/ton), Ohio ($42/ton) and New York ($49/tonne). What Stantec fails to mention is that the tip fees presented (obtained from the Waste & Recycling News June 2012 database, www.wasterecyclingnews.com) are the average tip fees at the largest (in terms of tonnes per day) landfill in each respective state.

Following the presentation of the US site tipping fee information, the Stantec report discusses a recent disposal arrangement established by the Peel Region in Ontario. An inferred tip fee value of $35 to $40 per tonne is presented in the Stantec analysis. Although not identified in the Stantec document, the disposal site in question is the Twin Creeks Landfill (permitted to accept 750,000 tonnes per year and operated by Waste Management of Canada) in Watford, ON. Similar to the other Ontario-based sites referenced by Stantec, this landfill uses a clay-only liner system. As discussed previously, liner systems of this type have not been permitted for MSW disposal sites in Nova Scotia for over 20 years.

The Stantec analysis characterizes the US and Twin Creeks (Ontario) tip fee information as being most relevant in the assessment of disposal costs at Otter Lake. To provide an idea of how representative these sites are in comparison to the Otter Lake RDF, **Table 2-1** presents some basic descriptive data for each location. A more detailed summary of information for all the landfill locations cited by Stantec in Section 3.3.2 of their document is provided in **Appendix A**.

Table 2-1 Comparative Landfills as Presented in the Stantec Report

Stantec Report Identifier	Site Name	Location	Owner	Landfill Liner Type	Tonnes Landfilled/Year (approximate)	Percentage of RDF's Annual Tonnage
HRM	Otter Lake RDF	Otter Lake	HRM	Double Composite	133,000	-
Michigan	Pine Tree Acres Landfill	Lenox Township, MI	Waste Management, Inc.	Single Composite[1]	1,300,000	977%
Maine	Juniper Ridge Landfill	Old Town, ME	State of Maine	Single Composite[1]	700,000	526%
Ohio	Rumpke Sanitary Landfill	Hamilton County, OH	Rumpke Consolidated Companies, Inc.	Single Composite[1]	2,600,000	1955%
New York	Seneca Meadows	Waterloo, NY	IESI/Seneca Meadows, Inc.	Double Composite[2]	1,560,000	1173%
Ontario (serving Peel Region)	Twin Creeks Landfill	Watford, ON	Waste Management of Canada	Clay	750,000	564%

Notes: 1. A less stringent landfill liner requirement as compared to NS; only one geomembrane layer.
2. A liner standard similar to the NS requirement.

The primary drivers influencing the cost per tonne to operate a landfill are required capital and annual operating expenditures (directly influenced by applicable regulatory requirements) and the number of tonnes (and the associated tip fee revenues) that cross the scale. The number of tonnes is often the key; the capital and basic operating costs (e.g., equipment and staff) tend to be set - the variable in the cost per tonne calculation is the number of tonnes an operator can attract to their site. Unfortunately, Stantec chose to compare the per tonne operating costs to sites that accept between five to over 18 times the amount of waste that is currently accepted at the RDF. Of particular note is the Rumpke Sanitary Landfill in Hamilton County, Ohio. Originally established in 1945 and referred to locally as "Mount Rumpke", it is the sixth largest landfill in the United States. In addition, three of the American sites selected have a less-stringent landfill

liner standard as compared to what is required in Nova Scotia, resulting in a notable reduction in the necessary capital expenditures at these locations. In the opinion of Dillon, selecting landfill operations to support a cost analysis of the Otter Lake RDF that have; a) lower design/environmental protection standards, and b) dramatic economy of scale cost advantages is inappropriate.

Provincial Implications

Section 4 of the Stantec report analyzes the existing Provincial liner standard for municipal solid waste landfills in Nova Scotia. With a focus on capital cost reduction, the analysis presents an argument for a reduction in the current liner standard, specifically the removal of upper cushion layer as well as the leak detection/collection system and its associated geomembrane liner. Since the liner standard was initially identified by NS Environment as the design requirement for new municipal solid waste landfills in 1992, the Province has been approached on several occasions to consider the potential of removing select components of the "double composite" (e.g., a low permeability soil layer between two geomembranes layers) configuration. To the knowledge of Dillon, with the exception of some minor refinements to select aspects of the overall liner system, no significant alterations have been approved. Even in instances where local geological conditions would mitigate the potential impacts of leachate breaching the liner system (e.g., the site being located on a thick veneer of glacial till); changes to the standard have not been accepted.

In 2002, the Resource Recovery Fund Board engaged Dillon to evaluate whether the success of composting, recycling and hazardous material recovery programs in Nova Scotia warranted a reduction in the Province's double composite landfill standard. The review was founded on the notion that removal of the primary contentious components of the municipal waste stream would result in a "lower-strength" leachate and thus a reduced potential for environmental impacts, including groundwater contamination. Following the review of data from several NS disposal sites (including the Otter Lake RDF), it was determined that the characteristics of leachate of from older pre-diversion program sites did not differ significantly enough from newer post-diversion program sites to warrant a reduction in the landfill liner standard. Thus, no changes to the Province's existing liner standard were recommended.

As discussed in **Section 2.2.1** of this document, the elevated level of protection offered by Nova Scotia's landfill liner standard (as compared to previous Provincial requirements and those

specified in other jurisdictions) has proven to be beneficial when addressing host community concerns regarding potential groundwater impacts. While the Stantec analysis focuses on potential financial benefits of a reduced Provincial landfill liner standard, it does not acknowledge that such changes would have implications to previous environmental control commitments made to host communities throughout the Province. If a reduction in the landfill liner standard was deemed appropriate in the case of the Otter Lake RDF (a disposal site situated primarily on fractured bedrock and adjacent to a river), it would most certainly be applicable to other existing and future sites throughout Nova Scotia. Based on the experience of Dillon, we would anticipate a significant level of community opposition (including potential legal action) to a reduction in a previously accepted landfill liner standard and its associated level of environmental protection.

Consequences of a Height Increase

While it is agreed that increasing the maximum design elevation of the RDF (e.g., vertical modifications) offers a practical opportunity to enhance the value of the RDF capital investments, there are potential operational and development challenges associated with a height increase that are not identified in Section 4.3 of the Stantec report. It is noted that several issues are described in Dillon's September 26, 2012 memorandum to MIRROR NS, included within Appendix A of the Stantec report While a detailed engineering analysis would be required to define the extent of the impacts, an increased final elevation could have several consequences that will have cost implications, including;

- Waste placement/sequencing limitations.
- Extended use of temporary landfill gas collection systems.
- Modification of existing landfill gas infrastructure.
- Staged installation and design modification of future landfill gas management infrastructure.
- Increased leachate production.
- Modified stormwater management provisions (e.g., terraced construction) to accommodate extended landfill side slopes.

These potential impacts require further consideration prior to identifying the cost implications of suggested revisions to the design of the RDF.

The System and Community Acceptance

Stantec's analysis of the effectiveness of the integrated processing and disposal facilities at the Otter Lake site overlooks one particularly important consideration; community acceptance. An underfunded, contentious waste management facility, such as the former Highway 101 landfill can have significant negative impacts on the surrounding community including stagnant development (and the associated tax revenues) and reductions in resident population. In the case of the Otter Lake Waste Processing and Disposal Facility, the opposite outcome has been experienced.

With reference to **Table 2-2**, and with reference to the period of 2001 to 2011, population growth in the two primary communities that are adjacent to the Otter Lake site, Timberlea and Hatchet Lake, has exceeded that experienced in HRM as a whole and has been in line with the significant growth in the overall area extending west from Halifax Harbour to the District of Chester, as defined by the boundaries of Chebucto West Community Health Board (including the communities of Timberlea, Beechville, Lakeside, Goodwood and Hatchet Lake).

Table 2-2 Changes in Area Population, 2001 to 2011

Community	Total Population		% Change
	2001	2011	2001-2011
Timberlea	8,141	9,388	**15.3**
Hatchet Lake	2,870	3,201	**11.5**
Chebucto West Community Health Board	77,173	89,335	**15.8**
HRM	359,185	390,330	**8.7**
Nova Scotia	908,005	921,725	**1.5**

Source: http://www.gov.ns.ca/finance/communitycounts

In terms of residential land development, the confidence in the reliability of the existing Otter Lake operation is perhaps best exemplified by the Brunello Estates project, situated in Timberlea approximately 3 km northeast of the RDF. Currently well into its first phase of development, Brunello Estates is scheduled to include 700 single family residences, over 2400 condominium/townhouse units and an 18 hole golf course and spa. In a CBC News report from April 23, 2013, and on the topic of potential changes to operations at Otter Lake, Rob Dexter, President of Brunello Estates commented, "The community had some pretty clear commitments over what would be done over there…they may make some changes but it will be the same kind

of quality." What is at issue is whether the removal of key components of the integrated system at Otter Lake, such as the FEP/WSF, will result in the "same kind of quality" in respect to the performance of the RDF and the associated level of comfort and acceptance of nearby residents.

2.2.3 Noted Issues of Concern

In summary, noted issues of concern with Stantec's analysis of the operation of the RDF are as follows:

1. Lack of acknowledgment and understanding of the unique characteristics of the waste and cover material at the RDF.
2. Inaccurate representation of the landfill gas generation characteristics of a processed waste versus unprocessed/raw waste disposal site.
3. Selection of unrepresentative landfill sites as a basis for an analysis of RDF operating costs.
4. Failure to recognize the local and provincial community commitment implications of reducing the current RDF liner standard.
5. Failure to identify potential cost and operational implications of increasing the RDF design height.
6. Lack of acknowledgement of the integrated relationship of the FEP/WSF/RDF and the resulting benefits of local community acceptance, population growth and developer confidence.

2.3 Regional Waste Resource Management Campus

Section 5 of the Stantec document discusses the benefits of co-locating several (and potentially all) of HRMs waste management facilities at one site. Asserting that the two existing composting facilities and the MRF in Bayers Lake are approaching the end of their service lives/operational capacities, Stantec argue that an opportunity exists to establish a more efficient centralized "waste resource campus". The following section of the report provides an analysis of the Stantec assessment, acknowledging the CSC's original intentions related to the location of processing facilities as well as a number of significant challenges associated with the development of a centralized campus.

2.3.1 Review of Stantec Analysis

The Goal of Decentralization

With regard to the selection of processing/management locations to support the establishment of the Halifax region's new waste management system, the CSC provided the following guidance in their 1995 Strategy document (specifically, within pages 21 to 26 and page 45):

- "The Recycling Facility will continue to be used in its current form as the new system is implemented, however it may be converted or modified to other uses in the future."
- "More material processing facilities will be developed and operated in the Metro-region if it is determined that it is more cost effective to do so, as compared to the use of the single Recycling Facility."
- "The source-separated (composting) facilities will be situated exclusive of mixed residue facilities."
- "Multiple sites and compost operators will be encouraged."
- "The (composting) facilities should be located close to the centres of generation. This will encourage residents to become familiar with composting activities and to accept composting as a key component of the system."
- "It is the preferred approach of the CSC to develop source-separated composting facilities as turn-key models (design/build/own/operate)…"
- "In comparison to one large facility, the CSC believes that several smaller facilities are more easily managed and operated, have lower overall system costs and are more readily achievable with the Strategy's implementation timetable. In addition, experience from other jurisdictions indicates that there appears to be a practical, optimal size for the successful operation of composting facilities."

The establishment of new facilities to support the implementation of HRM's finalized strategy acknowledged these objectives, with activities occurring at four locations under the direction of three different operators. Notably, all of HRM's current facilities are relatively close to the urban core of the region with efficient access to the existing highway network. An important aspect of the decentralized approach not recognized in the Stantec analysis is sharing the facility hosting responsibility amongst several communities within the overall service area. Placing the full hosting burden on a single community (e.g., as provided under a campus concept) runs contrary to the theme of equity found throughout the 1995 CSC Strategy document.

An Idealized Analysis

In contrast to what was presented in the CSC's 1995 Strategy document, Stantec highlight the potential advantages of a centralized campus approach in Section 5 of their report. Several benefits of co-locating waste management infrastructure at one site are identified, including improved collection efficiency, ease of facility retrofitting/ expansion, shared use of weigh scales, more efficient HRM oversight and the ability to establish compost curing pads.

To incorporate buffer areas as well as a location for an anaerobic composter (digester) for ICI organics, Stantec recommends a minimum property allowance of 40 hectares (100 acres) for a proposed campus. Noting there are specific regulatory siting requirements associated with composting and other waste management infrastructure, no assumptions, details or conceptual layouts are used to support this size estimate. The entire issue of siting, undoubtedly the most challenging aspect to establishing new waste management infrastructure, is addressed with a limited and somewhat confusing presentation within Stantec's report. For example, in Section 5, Stantec note the following:

- The current Otter Lake site could be a potential location for the campus, particularly if the FEP/WSF is decommissioned.
- Local geography limits suitable lands for the development of a waste resource campus to the area east of the Halifax/Dartmouth urban core. However, they also state that "little benefit" would be gained (we assume from an overall operational cost perspective) if the proposed campus was established in this part of HRM.
- HRM would need to evaluate available lands and the likely community acceptance of such a concept.

Thus, on the issue of the practicality of siting a contentious regional waste management facility, very little direction is provided. But even with this lack of clarity on the critical issue of siting, Stantec confidently present an aggressive development timeline for a regional waste resource campus. Noting that Stantec's report was issued in January 2013, they suggest that a site for the proposed 40 hectare campus could be identified, approved and initially developed by 2014; a 24 month timeline. A remarkably ambitious schedule, noting:

1. The Stantec report is yet to go through a planned public review.
2. Following the completion of the public review, Council will need to decide on a preferred path forward.

3. A consultant team will need to be engaged through an RFP process to refine the definition of the necessary campus components, conduct a siting/public engagement process and identify candidate campus locations.
4. Identification of necessary funding requirements to develop regional campus.
5. A public and political process will need to be defined/completed towards the identification of a single preferred regional campus site.
6. Purchase agreements for the selected campus property will need to be developed.
7. The process for developing the campus site will require definition by HRM (e.g., traditional design/tender/construct or design/build).
8. Detailed engineering documents to support the establishment of the campus will require preparation, consistent with HRM's preferred procurement model.
9. A period of time will be required for tender/bid preparation, review and contractor/proponent selection.
10. Municipal and Provincial approvals for the development of the campus will be acquired.
11. Construction of the initial campus components (roads, services, building pads) will need to be completed.

This significant list of "to do" items represents a partial presentation of the tasks to be completed over Stantec's proposed two year period. In the experience of Dillon, it is anticipated that Item #3 and Item #4 alone will take at least two years to complete. The impracticality of the schedule proposed in the Stantec document indicates a limited understanding of the technical, social and political complexities associated with the establishment of regional waste management infrastructure.

Development costs for the "full build out" of the proposed campus are provided in Section 5.5 of the Stantec document. Once again, no supporting details on the estimated costs are provided, noting that issues related to site location can greatly affect development requirements (e.g., access to a 100 series highway, proximity to three-phase electrical servicing and management of bedrock). One notable assumption presented in Section 5.5 is that the sale of the existing MRF (building and property) will fully offset the campus property purchase cost as well as the development costs for a new MRF and (seemingly) a single compost facility. A highly speculative assumption that is unsubstantiated within the Stantec document.

2.3.2 Noted Issues of Concern

In summary, noted issues of concern with Stantec's analysis of the proposed development of a regional waste resource campus are as follows:

1. Lack of recognition of the importance of a decentralized facility development model in relation to the original objectives of the 1995 CSC Strategy.
2. Preparation of an unrealistic and unsubstantiated estimate of the schedule and development costs required to establish a regional waste resource campus.

3.0 Conclusions

Dillon Consulting Limited conducted a review of Stantec's January 2013 document *Waste Resource Strategy Update* with a focus on Sections 3 (Otter Lake Waste Processing and Disposal Facility) 4 (Landfill Design) and 5 (Opportunity to Create a Regional Waste Resource Campus) of the report. Under each of these section headings, a summary of the noted issues of concern with the analysis presented in the Stantec document is as follows;

Section 3 - Otter Lake Waste Processing and Disposal Facility and Section 4 – Landfill Design

Front End Processing and Waste Stabilization Facility

1. Incorrect definition of the intended role of the FEP/WSF.
2. Inconsistent characterization of the current quantities of recyclables and compostables that exist within the mixed waste stream.
3. Unsubstantiated conclusion regarding the acceptability of disposing hazardous waste materials at the RDF.
4. Failure to acknowledge the mixed load deterrent and segregated material educational benefits of the FEP.
5. Failure to acknowledge the reduction in traditional landfill site nuisance concerns as a result of processing activities within the FEP/WSF.

Residuals Disposal Facility

1. Lack of acknowledgment and understanding of the unique characteristics of the waste and cover material at the RDF.
2. Inaccurate representation of the landfill gas generation characteristics of a processed waste versus unprocessed/raw waste disposal site.
3. Selection of unrepresentative landfill sites as a basis for an analysis of RDF operating costs.
4. Failure to recognize the local and provincial community commitment implications of reducing the current RDF liner standard.
5. Failure to identify potential cost and operational implications of increasing the RDF design height.

6. Lack of acknowledgement of the integrated operational relationship of the FEP/WSF/RDF and the resulting benefits of local community acceptance, population growth and developer confidence.

Section 5 - Regional Waste Resource Management Campus

1. Lack of recognition of the importance of a decentralized facility development model in relation to the original objectives of the 1995 CSC Strategy.
2. Preparation of an unrealistic and unsubstantiated estimate of the schedule and development costs required to establish a regional waste resource campus.

Generally, the analysis presented in the Stantec document could be characterized as a preliminary "desktop" review with very limited presentation of assumptions, estimation details and data sources. Particularly notable were the Canadian and American landfill sites selected for comparison to the Otter Lake RDF in terms of operational cost. Of the 11 sites brought forward for comparison in the Stantec document, five had "clay only" liner systems (which have not been permitted in NS for over 20 years) and five had incoming waste tonnages ranging from five to over 19 times the amount of material that is currently accepted at the Otter Lake RDF. These and other important details impacting the relevance of the sites brought forward for comparison are absent from the Stantec document.

Similarly, estimated costs for proposed facilities are presented in an unqualified manner and with very little supporting information. A primary example of this the capital cost estimate for a proposed regional waste resource campus provided in Section 5.5 of the Stantec report. In the absence of a conceptual facility layout, identification of any general site attributes (e.g., proximity to servicing, access to a highway network) or definition of a recommended contingency allowance, a capital cost estimate of $10 million is confidently provided.

Finally, the Stantec document presents an analysis with limited recognition of the social and political complexities associated with the development and implementation of a municipal waste management strategy. Issues such as previous community commitments (both locally and at the provincial level) and challenges associated with the siting of new waste management infrastructure are mentioned only in passing. Those who were involved in the long and contentious process to identify a waste resource management solution leading up to and following the closure of the Highway 101 Landfill site recognize the danger in this approach. If

the establishment of a municipal solid waste program could be conducted in the absence of public involvement with a primary focus on technical matters and costs, it would certainly make the task much easier for system managers. But as residents of HRM know, definition, implementation and ongoing operation of a comprehensive, integrated waste management program, to be successful, must be completed through direct and meaningful engagement with system users and host community residents.

Appendix A
Information Summary, Landfills Referenced in Waste Resource Strategy Update (Stantec, 2013)

Appendix A
Information on Landfills Referenced in Waste Resource Strategy Update (Stantec, 2013)

Site Name	Owner	Nearest Community	Location	Waste Type	Tonnes/Yr	Liner Requirement
Hartland Landfill	Capital Region District	Victoria, BC	1 Hartland Ave, (N: 5375687.00, E: 465922.00)	MSW	140,000	Single composite
Essex-Windsor Regional Landfill*	Essex-Windsor Solid Waste Authority	Essex, ON	7700 County Road 18, (N: 4676563.81, E: 330560.75)	MSW	175k-200k	In-situ clay with leachate collection layer
Halton Waste Management Site	Halton Region	Milton, ON	5400 Regional Road 25, Milton (N: 4814315.93, E: 595401.26)	MSW	92,000	Recompacted in-situ clay with leachate collection layer
Biggars Lane Landfill	County of Brant	Oakland, ON	128 Biggars Lane, (N: 4766497.73, E: 557833.62)	MSW	18,000	In-situ clay, potentially with leachate collection
Waterloo Waste Management Site*	Region of Waterloo	Waterloo, ON	925 Erb St. West, (N: 4810076.19, E: 534266.33)	MSW, C&D	220,000	Recompacted in-situ clay with leachate collection layer
FRSWC Landfill	Fredericton Region Solid Waste Commission	Fredericton, NB	1775 Alison Boulevard, (N: 5086730.79, E: 684230.76)	MSW	78,000	Single composite
Twin Creeks Landfill (site ref. at bottom of page 3.10 in Stantec report serving Peel Region)	Waste Management of Canada	Watford, ON	Zion Line, east of Nauvoo Road, (N: 4758854.00, E: 429280.00)	MSW, Contam Soil	750,000**	Engineered clay liner (no membrane)
Pine Tree Acres Landfill (MI)	Waste Management, Inc.	Lenox, MI	36600 29 Mile Road, (N: 4736192.24, E: 357182.69)	MSW	1,300,000	Single composite
Juniper Ridge Landfill (ME)	State of Maine	Oldtown, ME	Bennoch Rd, Alton (N: 4980958.22, E: 521678.09)	C&D, Ash, MSW	700,000	Single composite
Rumpke Sanitary Landfill (OH)	Rumpke Consolidated Companies, Inc.	Northgate, OH	10795 Hughes Road, (N: 4349993.00, E: 707661.00)	MSW, C&D	2,600,000***	Single composite
Seneca Meadows (NY)	IESI/Seneca Meadows, Inc.	Waterloo, NY	1786 Salcman Road, (N: 4753264.00, E: 349321.00)	MSW	1,560,000	Double composite

*: Dillon has specific experience at these sites.
**: Annual tonnage limit specified in site approval.
***: Based on 260 days of operation/year.

Appendix B
References

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Appendix C
Materials Banned from Landfills and Incinerators in Nova Scotia

Appendix C
Materials Banned from Landfills and Incinerators in Nova Scotia*

Column 1: Designated Material	Column 2: Implementation Date
Beverage containers	April 1, 1996
Corrugated cardboard	April 1, 1996
Newsprint	April 1, 1996
Used tires	April 1, 1996
Lead-acid (automotive) batteries	April 1, 1996
Leaf and yard waste	June 1, 1996
Post-consumer paint products, formerly known as waste paint	April 1, 1997
Ethylene glycol (automotive antifreeze)	April 1, 1997
Compostable organic material	June 1, 1997
Steel/tin food containers	April 1, 1998
Glass food containers	April 1, 1998
Low-density polyethylene bags and packaging	April 1, 1998
High-density polyethylene bags and packaging	April 1, 1998
Televisions	February 1, 2008
Desktop, laptop and notebook computers, including CPU's, keyboards, mice, cables and other components in the computer	February 1, 2008
Computer monitors	February 1, 2008
Computer printers, including printers that have scanning or fax capabilities or both	February 1, 2008
Computer scanners	February 1, 2009
Audio and video playback and recording systems	February 1, 2009
Telephones and fax machines	February 1, 2009
Cell phones and other wireless devices	February 1, 2009

*Source: http://www.gov.ns.ca/just/regulations/regs/envsolid.htm#TOC1_9