HALIFAX
REGIONAL MUNICIPALITY

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Item No. 3
Committee of the Whole
January 14, 2014
June 24, 2014

TO: Mayor Savage and Members of Halifax Regional Council

SUBMITTED BY: Original signed by

Richard Butts, Chief Administrative Officer

Original Signed by

Mike Labrecque, Deputy Chief Administrative Officer

DATE: January 8, 2014

SUBJECT: Integrated Solid-Waste Resource Management Strategy Review – Final Report

ORIGIN

Regional Council directed staff to assess the Integrated Solid-Waste Resource Management Strategy (ISWMS) to enhance system environmental and fiscal performance

LEGISLATIVE AUTHORITY

HRM Charter, Part XIII, Solid Waste Resource Management

RECOMMENDATIONS

It is recommended that Regional Council:

1. Confirm the objectives of the Community Stakeholders Committee Integrated Resource Management Strategy 1995:

    a. Maximize reduction, reuse and recycling of waste resources;
    b. Maximize environmental and fiscal sustainability of the waste program;
    c. Foster public stewardship and conservation.

RECOMMENDATIONS CONT'D ON NEXT PAGE

2. Direct staff to initiate development of a business case for the source separated organics program to introduce an Anaerobic Digestion processing capability and other program changes to improve system cost performance and compost quality and return to Regional Council with a revised plan by 30 June, 2014;

3. Initiate By-law amendments to improve organics collection, processing and finished compost product quality for residential source separated organics by:
    a. removing boxboard as a mandated green bin product (while still permitted as a kitchen scrap material catcher);
    b. mandating use of kraft paper bags for separate collection of leaf and yard waste; and,
    c. banning grass clippings from collection;

4. Direct staff to site a second household special handling waste depot and introduce annual district mobile household special handling waste events;

5. Initiate By-law amendments to:
    a. mandate clear bags (with one nested opaque bag) for residential collections; and,
    b. reduce garbage bag limits from 6 to 4;

6. Direct staff to increase:

    a. curb-side education and monitoring;
    b. apartment tenant education and monitoring; and,
    c. ICI load monitoring and inspections at the landfill;

7. Amend By-law S-600 to allow for the export of ICI residual waste (garbage) outside HRM, and amend Administrative Order number 16 to provide for an increase in fees for disposal of ICI residual waste from $125 per tonne to the assessed system cost of $170.00 per tonne;

8. Direct staff to initiate consultation with MIRROR NS and the Community Monitoring Committee on options for changes in the operating model (front end processor facility, waste stabilization facility, residual disposal facility) at Otter Lake landfill site A, returning to Council with a transition plan for landfill operations at the site based on diversion outcomes resulting from the changes outlined in this report; and

9. Extend operations at Otter Lake beyond 2024 and direct staff to increase the vertical height of existing and future cells by 15 meters and establish an Integrated Solid Waste Management Campus at the site to support new facilities and alternative technologies as they become viable.

EXECUTIVE SUMMARY

Halifax Regional Municipality – Integrated Solid Waste Management Strategy (ISWMS) System Review

HRM's ISWMS was based in principle on the Community Stakeholders Committee (CSC) consultation process which created An Integrated Waste/Resource Management Strategy, dated March 25, 1995. That process was mandated as a result of the outcomes from the Sackville Landfill and its negative impact on the community and environment. The subsequently implemented ISWMS 1997 changed two critical conditions of the original strategy. The ISWMS plan changes resulted in continued reliance on pre-processing prior to disposal at the landfill compounding long-term escalating system costs.

The ISWMS system review identified a number of program and system changes to achieve Regional Council's directive to enhance system environmental and fiscal performance. The system review confirmed that HRM has made progress in terms of the integrated waste management strategy objectives. However, HRM failed to achieve the intended outcomes of the CSC Strategy, 1995 as a result of the changes to the implemented ISWMS plan 1997. The current ISWMS plan does not meet the environmental or fiscal objectives of the CSC Strategy.

The ISWMS Review identified system changes which can meet the CSC Strategy objectives. The outlined options in this report would significantly increase diversion from Otter Lake within 3 years. Statistical data supports the analysis that the changes will reduce delivered putrescible organics below 5,000 tonnes per year from the current approximately 25,000 tonnes at Otter Lake. Waste stream data indicates that over 5,000 tonnes of putrescible organics currently goes directly into the landfill without passing through the waste stabilization facility (WSF). The outlined changes would essentially empty the WSF facility.

The recommended system changes will achieve the CSC strategy objectives and enable re-evaluation of the current operating model at the landfill.

The system review identified options to improve overall ISWMS fiscal and environmental performance. The changes include:

- Confirm anew the CSC Strategy objectives;
- Improve compost quality and reduce organics program costs through processing changes, collection changes and by-law changes to improve monitoring and compliance;
- Improve household special handling waste program diversion and visibility through the establishment of a second permanent depot, reviewing depot hours or operation and establishing new district mobile events to be held yearly;
- Reduce materials delivered to Otter Lake landfill by allowing the export of residual waste (garbage) outside HRM saving landfill cell capacity and increased education, monitoring and compliance efforts;

- Improve the environmental and fiscal performance of landfill operations through negotiated modifications to the operating model as a result of system outcomes from these recommended program changes;

- Reduce future ISWMS system requirement costs through extending operations at Otter Lake beyond 2024, and increasing cell height by 15 meters; and,

- Increase strategic adaptability of the ISWMS system program through establishment of an ISWMS campus at the Otter Lake site where new projects and facilities will be developed.

The ISWMS Review confirmed that a campus model provides for the most adaptable, cost effective and efficient ISWMS program. While this is a departure from the CSC strategy vision of dissipated sites, consolidating facilities enables greater flexibility to incorporate alternative technologies and industry advancements in terms of equipment, collection systems and material resource management. A campus scenario also enhances the opportunities from a regionalized waste management perspective. The logical location for a campus site in terms of environmental, social and fiscal sustainability is at the current Otter Lake site.

The ISWMS review confirmed the ability to achieve Regional Council's directive to improve fiscal performance and environmental stewardship. A decision to remain at Otter Lake can significantly reduce program costs and future system costs by extending operations beyond 2024 and capitalizing on the existing investment in Cells 1 through 6 through vertical extension. A campus site will also include development of a landfill gas to energy project and enable future energy from waste projects to provide power and heat for campus facilities. Remaining at Otter Lake eliminates a potential 100 million dollar landfill siting project.

BACKGROUND

a. The Solid Waste Strategy Review Process

Regional Council directed staff to assess the Integrated Solid Waste Resource Management Strategy System (ISWMS) program to enhance environmental stewardship and improve fiscal performance.

The review of the ISWMS originated from a Community Monitoring Committee (CMC) letter dated 9 September, 2010. CMC requested Regional Council direct staff to consult with CMC on determining the specific closure date for the Otter Lake landfill. The Community Stakeholder Committee (CSC) Strategy vision was to reduce HRM's reliance on landfilling through diversion of resources. CMC's request to determine the future of HRM's Otter Lake landfill was an appropriate time to review the ISWMS in terms of HRM's progress in achieving the objectives of the citizen developed An Integrated Solid Waste Resource Strategy, 1995.[1]

[1] An Integrated ~~Waste~~/Resource Management Strategy, dated March 25, 1995.

Early in 2011, staff initiated a comprehensive assessment of the ISWMS. Staff research and analysis included a review of:

- the vision and objectives of the original CSC Strategy approved in principle by Regional Council, 25 March, 1995;
- the revised ISWMS plan implemented in 1997;
- the evolution of waste management legislation in NS and HRM since the mid-1990's; and,
- the evolution of the waste industry, technology and waste streams since HRM's revised ISWMS was implemented in 1997.

On 20 September, 2011, Regional Council directed staff to "Commence the community engagement process, including consultation with the CMC and consideration by the Environmental and Sustainability Standing Committee, to review the Waste Resource Strategy, to include assessment of alternative options".

Subsequently, staff were authorised to contract for an independent consultant review of the ISWMS. On 10 July, 2012, Regional Council approved the requested budget increase and passed the following motions:

1. Authorize the CAO to issue and award the RFP – System Review, Performance Assessment and Options Analysis; and,
2. Direct staff to follow the community consultation process outlined in the September 20, 2011, Regional Council motion.

The Province's Environmental Goals Sustainable Prosperity Act (EGSPA) and HRM's ISWMS use diversion of resources from landfill as a primary measure of system performance. Fiscal performance is based on overall system costs. The overall ISWMS program review was based on three criteria:

1) Assess system performance based on original strategy objectives;
2) Conduct industry bench mark analysis and comparative best practice assessments; and,
3) Identify options and recommendations to enhance system effectiveness and efficiency.[2]

Stantec was awarded the HRM Solid Waste System Review, Performance Assessment and Options Analysis project. Stantec's report (Attachment A) was presented to Regional Council in January 2013. An independent peer review of the Stantec report was also completed by SNC Lavalin's Environmental Division (Attachment B).

[2] REQUEST FOR PROPOSALS, HRM Solid Waste Resource Strategy System Review, Performance Assessment and Options Analysis, RFP #12-061, July 2012.

Concurrent to the Peer review analysis, staff developed a consultation framework as per the approved 2008 Community Engagement policy and direction from Regional Council.

The following motion was approved at the 23 April, 2013 Regional Council session.

Motion of Regional Council:

1. Release the Stantec Waste Resource Strategy report January, 2013.
2. Direct Staff to initiate public consultation on the Stantec Report options and recommendations beginning with the community monitoring committee and in particular recommendations A1 and A3 that:
    i. The Front End Processor FEP and Waste Stabilization facility (WSF) be closed by the end of 2013; and,
    ii. The life of the Otter Lake Landfill be extended through vertical expansion.
3. Direct staff that as part of the public consultation process to initiate discussions with the operator of the Otter Lake Landfill concerning the implications of the Stantec Report options and recommendations.
4. Direct the CAO to report to the Environmental and Sustainability Standing Committee.

HRM contracted National Public Relations to facilitate the community engagement consultation process in accordance with the Regional Council motion and approved framework. The consultation process was completed and National Public Relations submitted their final report on 6 December, 2013 (Attachment C).

b. History of HRM's Integrated Solid Waste Management System

i. The CSC Strategy Vision, 1995

The CSC Strategy vision for a municipal waste management regime was described as:

> …an achievable vision which has:
>
> - The least possible negative impact on the natural environment;
> - The most effective methods of collecting, processing, recovering and reusing the material resources produced and consumed by our communities; and,
> - The most responsible format for minimizing the amount of inert residues which emerge as the final product of the resource management system.[3]

Authors who first envisioned the CSC Strategy regime said:

[3] An Integrated ~~Waste~~/Resource Management Strategy, page vi, dated March 25, 1995.

> "*To achieve this vision, we must shift from our present focus on waste management to focus on the conservation and appropriate use of resources. As long as we think primarily of how to deal with waste, even if our objective is to minimize waste, we will ignore the fundamental use of resources."*[4]

The CSC Strategy assumed a new position: waste stream materials were resources not garbage. The Strategy outlined a model to reduce society's reliance on landfill to minimize the associated negative environmental and community impacts. This stewardship driven position was in response to the challenges resulting from the Sackville Landfill. The strategy required behavioural changes to absolutely minimize materials ending up in a landfill.

CSC created three objectives to support their vision:

- Maximize reduction, reuse and recycling of waste resources
- Maximize environmental and fiscal sustainability of the waste program
- Foster public stewardship and conservation[5]

The CSC established an ambitious target of 88% of the waste stream diverted to organic and recyclable processing by the year 2000.[6] However, this was based on an assessment that organics represented approximately 47% of the waste stream. We know today that this assessment was inaccurate. Organics currently represents only 22% of the waste stream. Garbage also currently represents 22% of the waste stream. Therefore, if all organics and recyclables were diverted, the best HRM could achieve would be 78% diversion.

The CSC Strategy incorporated reduced long-term landfill costs and the generation of revenues from recycled materials to offset implementation and initial higher system costs. Program innovations included:

- Separation of organic waste stream materials by residents and businesses at point of generation through provision of green carts;
- Organics processing plants to create marketable and revenue generating compost;
- Separation of recycling materials at point of generation to protect their value;
- Multiple waste streams processed at separate processing plants to divert materials from landfill;
- Interim processing and stabilizing of organics remaining in the garbage stream through a Waste Stabilization Facility (WSF) into marketable low grade compost and diversion from landfill;
- Interim processing, separation and diversion of recyclables remaining in the garbage stream through the Front End Processor for revenue and diversion from landfill.

[4] J. Jackson & B. Wallace, "Resource Management Systems: An Alternative to Current Waste Management Systems," study, 1993.
[5] An Integrated ~~Waste~~/Resource Management Strategy, page 4, 1995.
[6] An Integrated ~~Waste~~/Resource Management Strategy, Chart 3-1, 1995.

The CSC Strategy objective of behavioural change was founded on source-separation of materials at the point of generation. Source separation would achieve environmental protection and reduce reliance on landfill. Source separation would leave only inert residual materials to go to landfill. Education and monitoring were critical in establishing the new regime. Fiscal sustainability was based on long-term system cost savings from lower long-term landfill costs resulting from significantly reduced tonnage being delivered to landfill.

The CSC Strategy envisioned a long-term solution which would:

- reduce reliance and costs of landfill,
- reduce the physical impacts of landfill on the environment,
- minimize the negative impacts from leachate, gases, odours and vectors, and,
- provide an environmentally and fiscally sustainable waste management system for the Region that would be "acceptable for the next 100 years…"[7]

The CSC strategy recognized that achievement of the behavioural change objective would take time. The Strategy committed to interim processing of garbage to divert organics and recyclable materials remaining in the black bag garbage stream while behaviours changed. The Front End Processor (FEP) and Waste Stabilization Facility (WSF) would divert improperly separated materials from the landfill and capitalize on their value as resources. The resulting revenues would offset the interim processing costs.

The strategy envisioned that the FEP/WSF model would be "scaled down in a planned manner as source separated centralized composting scaled up."[8] Environmental and community protection were derived from behavioural change and source separation and the landfill cell liner designs and specifications. In the CSC Strategy, the mechanical FEP/WSF system was not intended as the environmental and community protection. The FEP/WSF system was intended to recover resources for revenue to offset system costs.

The Strategy outlined system changes and expectations to enable HRM's evolution to a conserver society. Managing of the system changes would be a challenge, which was the principal reason for a single proponent to have oversight and management of the entire system. However, the subsequent plan implemented to support the ISWMS incorporated several changes.

ii. The Implemented Integrated Solid Waste Management Strategy System Model 1996-1999

CSC Strategy success meant all organics went to compost processing plants, all recycling materials went to recycling plants and the remaining inert residual waste materials would be stored in landfill. The ultimate objective was for inert materials stored in the landfill, eventually free of toxics and organics, to be available for later recovery and use.[9] Green carts and organics separation were the innovative keys to practically and sustainably minimize organic materials in

[7] An Integrated ~~Waste~~/Resource Management Strategy for Halifax County/Halifax/Dartmouth/Bedford, Prepared by The Community Stakeholder Committee (CSC) and Adopted in Principle, page 2, March 25, 1995.
[8] An Integrated ~~Waste~~/Resource Management Strategy, page 7, 1995.
[9] An Integrated ~~Waste~~/Resource Management Strategy, page ii, dated March 25, 1995.

the landfill and the negative environmental impact of odorous greenhouse gases (GHG) and leachate.

In 1996, Council was presented with a revised ISWMS implementation plan which changed the outcomes of the Strategy in terms of diversion and disposal. MIRROR NS's analysis was that there were less organics in HRM than the Strategy projected, and that they could find no evidence of a successfully operated positive organics sorting system.[10]

> *"MIRROR cannot find evidence of any operation in the world that can substantiate these recovery rates for sorting organics, nor for any successfully operated positive sorting system of organic. Consequently, the FEP organics diversion rate proposed in this plan is lower than that of the Strategy, based on a negative sort (selecting out the more easily removable inert materials, such as paper and cans, leaving organics behind) and financial constraints on the FEP process."*[11]

Within a year of the CSC Strategy's "approval in principle," MIRROR NS and those involved in the ISWMS implementation process determined that the Strategy objectives were not practical from a fiscal or operational perspective. The CSC remained engaged through this process. Changes were made to accommodate what the proponent felt were reasonable adjustments to the system.

The implemented ISWMS plan, 1997, incorporated many of the key innovations of the CSC Strategy 1995, including: source separation, green carts, multi-stream recycling, and organics processing. However, the ISWMS plan incorporated two changes from the CSC Strategy, which affected system outcomes and shifted responsibilities in the proposed new ISWMS plan regime between HRM and the proponent MIRROR NS.[12]

Firstly, the implemented ISWMS plan incorporated changes to the landfill operations plan to address challenges with assessed system cost and practicality implications. Diversion of resources mixed in with inert residual waste materials delivered to the landfill was changed to processing, stabilizing, limited diversion but mainly disposal in the landfill.

The change from diversion to disposal of materials at the landfill was a major shift from the CSC Strategy objectives envisioned by HRM citizens. This change resulted in long-term landfill processing dependency and escalating system costs, all while the CSC strategy diversion goals continue to not be met.

Secondly, the Strategy intended for a single contracted proponent to assume responsibility for overall ISWMS implementation and management. The single proponent would have total control over all system components and all program measures. The CSC Strategy assessed a high level

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[10] Metropolitan Halifax Solid Waste/Resource Management System Implementation Plan, MIRROR Nova Scotia, page 7, September 15 1995.
[11] Metropolitan Halifax Solid Waste/Resource Management System Implementation Plan, MIRROR Nova Scotia, page 7, September 15 1995.
[12] *Revised Regional Solid Waste/Resource Management Plan Framework RE; Scope and Utility of the FEP/WSF, 3 May 1996, Solid Waste Resource Advisory Committee MOU.*

of risk associated with the objective of 88% diversion by 2000.[13] This risk was reflected in the acknowledged higher program costs. The contracted proponent, staff, (in consultation with the selected proponent, MIRROR NS) and Sound Resources (another consultant firm involved in the process) revised this single proponent approach. HRM assumed responsibility of program implementation and management of everything except operation of the landfill. MIRROR NS assumed responsibility for landfill development and operations only.

Excerpts from the revised plan report detailing the framework changes are:

> *8. FEP & WSF*
>
> *a) FEP was to be designed for minimal sorting. The machines would separate metals from the stream and minimal screening capability (i.e. trommel only) was intended for separating the putrescible organics from the mixed waste stream for stabilization.*[14]
>
> *11. Proposed Business Relationship Structure*
>
> *a) MIRROR will design, build, and operate the front end processing – waste stabilization plant as well as the residuals disposal facility.*
> *b) HRM assumed day to day operations administration, policy making and oversight authority of the integrated system.*[15]

In the span of one year, 1995 to 1996, following hundreds of citizen consultation meetings and the resulting approval in principal of the CSC Strategy, the vision was fundamentally reversed. Diversion from landfill became disposal in landfill based on the need to reduce costs. The system would only mechanically screen materials and stabilize organics prior to disposal in the RDF (landfill).[16] Diversion from landfill was still an objective, but this outcome was to be achieved only through source separation.

In 1998, before the Otter Lake site was fully operational, in an interview with the Daily News describing the functionality of the FEP-WSF, a senior representative of MIRROR NS described the process of FEP-WSF stabilization this way:

> "*We have to ensure there is no rotable material going into the RDF. Not only does it make sense from an environmental stand point, but as an operator it also makes sense in terms of less methane, odour and strength of leachate." "By putting the residuals through the WSF, we achieve an environmentally inert material. What nature takes 30 years to do, the WSF does in 18-21 days."*[17]

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[13] An Integrated ~~Waste~~/Resource Management Strategy, Chart 3-1, 1995.
[14] *Revised Regional Solid Waste/Resource Management Plan Framework RE; Scope and Utility of the FEP/WSF, 3 May 1996, Solid Waste Resource Advisory Committee MOU.*
[15] *Revised Regional Solid Waste/Resource Management Plan Framework RE; Scope and Utility of the FEP/WSF, 3 May 1996, Solid Waste Resource Advisory Committee MOU.*
[16] Revised Regional Solid Waste/Resource Management Plan Framework RE; Scope and Utility of the FEP/WSF, 3 May 1996, Solid Waste Resource Advisory Committee MOU.
[17] Supplement to the Sunday Daily News, October 18th, 1998, Nova Scotia Business Journal, Grand Opening Otter Lake, Halifax Regional Municipality, *Otter Lake a Homegrown Solution*, page 4.

The expected outcome from the processing of materials through the FEP-WSF was elimination of the negative environmental impacts of gases, odours, leachate and vectors.[18] However, within two year after operations began, in 2001, gases and odours began generating numerous complaints from neighbouring residents. Odours were unanticipated given the stabilization process.

Stabilization was supposed to eliminate gases and odours. The Otter Lake cell was new, open, and receiving only stabilized putrescible organics. Gases and odours should not have been an issue. MIRROR NS developed a pre-closure gas and odour management system of temporary piping and wells to capture and flare off the fugitive gases escaping from the active cell. This fix currently adds approximately $750,000.00/year to operating expenses at the site.

The rapid generation of fugitive gases and odours were unintended consequences of the FEP/WSF processing operation which MIRROR NS was mandated to correct. The added cost of the FEP/WSF processing was intended to eliminate this outcome. Instead, the FEP/WSF facilities actually created a new problem. The cost of correcting this undesired FEP/WSF outcome remains an on-going additional operating expense borne solely by HRM under the current agreement. Since its implementation, the temporary gas and odour management fix has added approximately $5,250,000 to HRM costs.

HRM pays all costs for operating the site. In addition, HRM pays a fixed percentage of those costs as a profit to the operator. In the current contract, MIRROR NS is paid $0.25 for every dollar spent at Otter Lake in terms of operating expenses.

This type of services contract is called a Cost Plus Percentage of Cost (CPPC) contract agreement. This type of agreement does not favour the buyer of the service since there is no incentive for the service provider to reduce costs or find efficiencies. Project Management theory describes this type of agreement as follows:

> *Cost plus fee or Cost Plus Percentage of Cost (CPPC)*
>
> *Not valid for federal contracts. Sellers are not motivated to control cost, used when buyer can tell what is needed then what to do. Seller writes SOW. Bad for buyer*,[19]

The ISWMS Plan changes resulted in two outcomes contrary to the CSC strategy vision.

1. The ongoing dependence on machine processing prior to disposal resulted in landfill operation costs which became almost double industry standards and continue to rise even while the tonnage of waste processed declines.

[18] Appendix Q, Operations Plan, Agreement For The Design, Construction And Operation Of Components Of The Halifax Regional Municipality's Solid Waste Facilities," page 21, dated July 25, 1997.
[19] http://www.projectmanagement.net.au/pmbok-procurement-management-contract-types, By Rod Hutchings, PMP, CPPD, SCPM, MAppSc| September 30, 2011.

2. During the consultation process, there were repeated references to the fact that the FEP/WSF processing is identified by some members of the local community and CMC as the source of environmental and community protection.

iii. ISWMS from 1999 through 2014

By-law S-600 governs the ISWMS program. Over the past 15 years, there have been several changes to S-600. These include such amendments as modifications to the recycling stream material, what goes in the blue bag, the separation of paper from corrugated cardboard, and garbage bag limit reductions. S-600 also divides the ISWMS between the residential collection regime and the Industrial Commercial & Institutional (ICI) sector.

The ICI sector is responsible for contracting private haulers for waste services and the mandated delivery to HRM facilities.

During 2001, based on an assessed reduction in waste materials arriving at the Otter Lake landfill, it was determined that private hauler companies were transporting materials to landfills outside HRM jurisdiction. This was resulting in reduced tip fee revenues. To counter the loss of tip fee revenues, HRM implemented what is known as *flow control*.

In 2002, By-law S-600 (S-602) was amended implementing flow control restricting the export of residual waste, organics and C&D materials generated within HRM. This ISWMS initiative was implemented to secure revenues from tip fees (ICI garbage and organics) to address the higher costs of providing the ISWMS system in HRM. At the time costs to utilize adjacent regional landfills were lower than tip fees at Otter Lake.

iv. Current ISWMS Model

As a result of the changes to the ISWMS Plan, the CSC Strategy was essentially never implemented. HRM remains dependent on landfill and FEP/WSF processing prior to disposal. Diversion from landfill through source separation has only partially been achieved. However, Regional Council remains committed to the CSC Strategy, 1995. The existing ISWMS is not achieving the fiscal performance and reduced reliance on landfill outcomes of the original CSC strategy envisioned by HRM citizens.

HRM's ISWMS model is split between residential and ICI sectors. HRM manages collections of all materials generated by residents within the defined residential sector. The residential sector includes single family houses, semi-detached, townhouses, rowhouses, mobile homes, condominiums and multi-residential apartment buildings with six or less units. The residential sector excludes private investment property apartment buildings and complexes. The ICI sector is responsible to contract for waste management services.

Municipal solid waste materials (residual garbage, organics and C&D) generated in HRM must be delivered to HRM waste processing facilities which include:

- Two organics processing plants, one each in Burnside and Ragged Lake industrial parks (materials exceeding capacity are sent to a processing outside HRM)
- One operational Landfill at Otter Lake site A

C&D waste materials are also prohibited from export outside HRM and must be taken to a licensed C&D depot, processing and landfill site within HRM.

Due to organics collection exceeding current processing capacity, HRM has established contracts for processing organics outside HRM. In addition, some special wastes, such as medical and international wastes, and compost plant residual materials and contaminants are sent to processing sites and landfills outside of HRM.

ICI sector recyclable materials are processed at a few private fibre processing facilities in HRM (for most ICI sector cardboard and paper) and at HRM's Materials Recovery Facility (MRF) located at Bayer's Lake Industrial Park (for ICI sector container recyclables and some paper). ICI sector recyclable materials are permitted to go to other jurisdictions but remain in HRM likely due to transport and processing costs and lack of processing capability elsewhere.

DISCUSSION

The ISWMS program review examined the overall system, from curb-side collection of all streams to processing and revenue generation, to identify ways to improve fiscal performance and environmental stewardship. The review consisted of three criteria:

- Assess overall system performance based on original strategy objectives;
- Conduct industry bench mark analysis and comparative best practice assessments; and,
- Identify options and recommendations to enhance overall system effectiveness and efficiency.[20]

The following discussion incorporates three years of staff research and analysis, the Stantec Review, the SNC Lavalin Peer review, Community Consultation, ICI input, CMC input, the Dillon report commissioned by MIRROR NS and the Arnold memo commissioned by Dillon Consulting Ltd, letters and petitions sent to Regional Council and National Public Relations' consultation report.

As a result of the system interdependencies, the discussion includes a general statement of system performance as a whole followed by individual analysis of component parts.

Components include:

- Organics program
- Recycling program

[20] REQUEST FOR PROPOSALS, HRM Solid Waste Resource Strategy System Review, Performance Assessment and Options Analysis, RFP #12-061, July 2012.

- Household Special Handling Waste
- Residual Waste/Garbage
- FEP/WSF
- Otter Lake Landfill

Each component will be addressed in terms of:

- Successes
- Challenges
- Opportunities
- Consultation Feedback
- Recommendation

In assessing the ISWMS system performance, based on CSC Strategy objectives, staff's analysis focused on two key performance indicators (KPI):

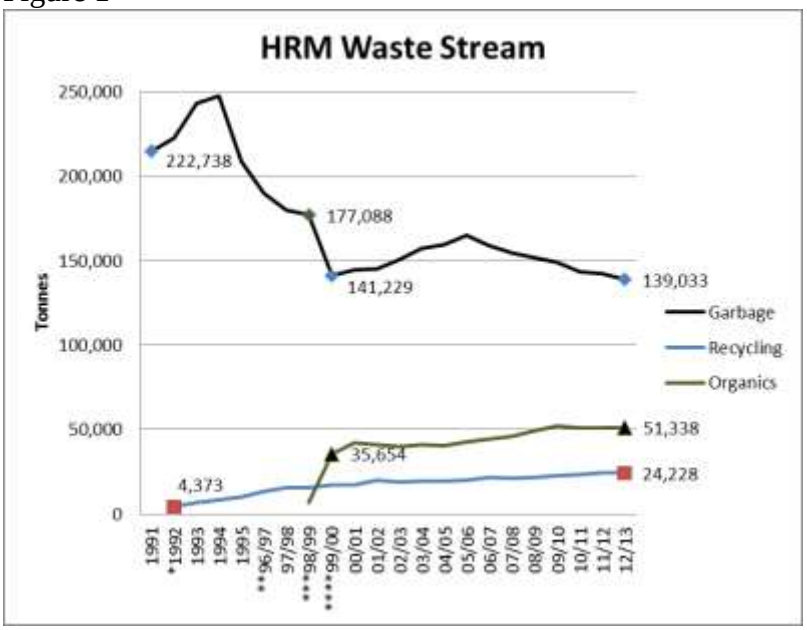
A. Rate of Diversion - Diversion consists of diverting waste resource materials at point of generation to an appropriate processing site other than landfill. The diversion target is 78% based on there being 22% garbage in the waste stream; and,

B. Overall System Costs - System costs are generated through collections, resource material processing, resident and business education, monitoring, inspections and landfill costs, both operating and capital.

A. Integrated Solid Waste Management System Report Card

In 2012, over 140,000 tonnes of materials were delivered to the Otter Lake landfill. Of that, approximately 80,000 tonnes (which represents 22% of the total of 366,100 tonnes of waste resource materials generated within HRM in 2012) was designated as garbage and was correctly sent to landfill. The remaining 60,000 tonnes are recyclable and represent a significant opportunity to enhance system environmental stewardship and fiscal performance. The figure below shows the historical effects of the source separation measures in HRM. The dramatic decline in garbage (top line) was influenced by the introduction of green carts, expansion of blue bag recycling and subsequent diversion of C&D materials from landfill.

Figure 1



The original CSC Strategy was developed at a time when there was limited recycling collection and no source separated organics (SSO) collection and processing.

As of 2013:

- HRM has achieved a 61% blended residential and ICI overall diversion rate, which is a significant achievement when compared to the rest of the country. A critical factor in understanding this number is that it still includes the garbage tonnage. There are over 81,000 tonnes of garbage in HRM's waste stream (22%) which is garbage and should go to landfill.
- ICI diversion is 66%, based in large part to C&D diversion and HRM's use of C&D engineered cover matrix as landfill cell daily cover.
- Residential diversion is 52%, one of the highest in Canada for similar sized cities when factoring in garbage generation.

Compared to the original CSC Strategy target of 88% diversion by 2000, 61% diversion may seem low. However, the CSC Strategy assessment of the waste stream make-up put organics at 47%. MIRROR NS, in its subsequent planning analysis, estimated that organics made up only approximately 27% of the waste stream.[21] Current data puts organics at approximately 22% and garbage at 22% of the waste stream make-up.

Table 1 shows the current make-up of the waste stream divided into individual streams with amount (tonnes) and diversion rate of each waste/resource stream, and to which facility it was

[21] Metropolitan Halifax Solid Waste/Resource Management System Implementation Plan, MIRROR Nova Scotia, page 7, September 15 1995.

delivered. The bottom row shows the overall diversion rate for the individual waste streams and the cumulative overall rate for HRM at 61%.

HRM is currently the only region in NS who regulates C&D materials. HRM also utilizes a significant percentage of the processed C&D as daily cover in the landfill cells which also counts as diversion.

Table 1

Waste/Resource System Mass Balance by Facility and Waste Stream

Fiscal 2011/2012	Garbage	Organics	Recyclable Paper and Cardboard	Recyclable Containers	C&D Material	Other	System Total
Otter Lake	82,376	24,254	19,347	8,760	7,320	613	142,670
MRF			18,858	5,460			24,318
Private Recycling			43,000				43,000
Enviro Depots				7,500			7,500
Compost Facilities		51,328					51,328
Backyard Composting		5,000					5,000
C & D Facilities					92,268		92,268
HHW (Est)						500	500
Totals	82,376	80,582	81,205	21,720	99,588	1,113	366,584
Diversion (% of Totals)		70%	76%	60%	93%	45%	61%

Of note: Nova Scotia Environment (NSE) calculates diversion rate differently than HRM. NSE compares a Region's current per capita disposal with the Region's 1984 per capita disposal. Using this formula, NSE sets HRM's overall diversion rate at 53%.

When examining waste resource streams individually, as of 2012/13, the rates are:

- 70% diversion for organics,
- over 75% diversion for recyclables, and,
- over 75% diversion of C&D recognizing that some C&D materials are used in daily cover at Otter Lake landfill and the operation of the private C&D landfill at Antrim.

HRM's waste generation rate of 393 kg of garbage per capita is a significant diversion achievement. The national average is over 800 kg per capita. In terms of CSC Strategy objectives of diverting organic materials, HRM residents and businesses have made significant progress. However, over 20,000 tonnes of putrescible organics remains in the mixed waste stream of which over 5,000 tonnes goes directly to the landfill without stabilization in the WSF. (see Appendix 7, Figure 23, Summary of Waste Stream Data).

The Province's EGSPA provincial target of 300 kg per capita for all of Nova Scotia in 2015 remains a challenging objective. Halifax alone would need to divert a further 25,000 tonnes from landfill.

Current landfill capacity at the Otter Lake site is based on generation of garbage by both the ICI and residential sectors. HRM is currently utilizing Cell 6, which opened in October 2012 and is projected to reach capacity in the summer of 2016. Construction of Cell 7 must commence during the 2015 construction season. This will require approval of the projected $19 million dollar project for the FY2015/16 capital budget.

Table 2 below identifies overall ISWMS program costs for the next ten years. These costs include infrastructure capital investments to address capacity, lifecycle and regulatory compliance. This includes:

- New Recycling Facility - $10,000,000
- Secondary Compost Curing Site - $3,500,000
- Increase Organics Capacity - $5,000,000
- Multiple Stream Collection Carts (Blue/Green) - $25,500,000
- New Landfill Site - $100,000,000
- Total = $144,000,000

Table 2

OPERATING	2014	2015	2016	2017	2018	5 Year Total Cost	Total to 2024/25
Total Operating	$34,200,000	$32,300,000	$34,700,000	$37,100,000	$39,800,000	$178,100,000	$479,500,000
Total Capital Funding	$10,403,000	$10,903,000	$10,603,000	$10,903,000	$11,500,000	$54,312,000	$126,312,000
New Capital Total	$0	$8,500,000	$10,000,000	$25,440,000	$100,000,000	$143,940,000	$143,940,000
ANNUAL FUNDING FOR SOLID WASTE	**$44,603,000**	**$51,703,000**	**$55,303,000**	**$73,443,000**	**$151,300,000**	**$376,352,000**	**$749,752,000**

Note: New infrastructure costs have been identified in terms of potential future system costs. Infrastructure development requirements can be met through public or private RFP funding of capital projects. Full business case analysis will determine the appropriate mechanism to meet the future infrastructure development requirements.

The above outlined future system costs do not reflect operating model changes at Otter Lake. The recommendations outlined in this report provide for a dramatic reduction in tonnage delivered to Otter Lake. The changes also represent cell construction cost avoidance. These changes will reduce operating costs of the current price agreement with MIRROR NS. In addition, there are other measures which will further improve fiscal performance. However, these operating cost savings have not been included in the system cost avoidance and cost savings calculations shown in subsequent cost tables. The recommendations are based on current identified system savings and cost avoidance, and not future negotiated price agreement operating cost savings.

Recommendation # 1 re: ISWMS

Confirm the objectives of the Community Stakeholders Committee Integrated Resource Management Strategy 1995:

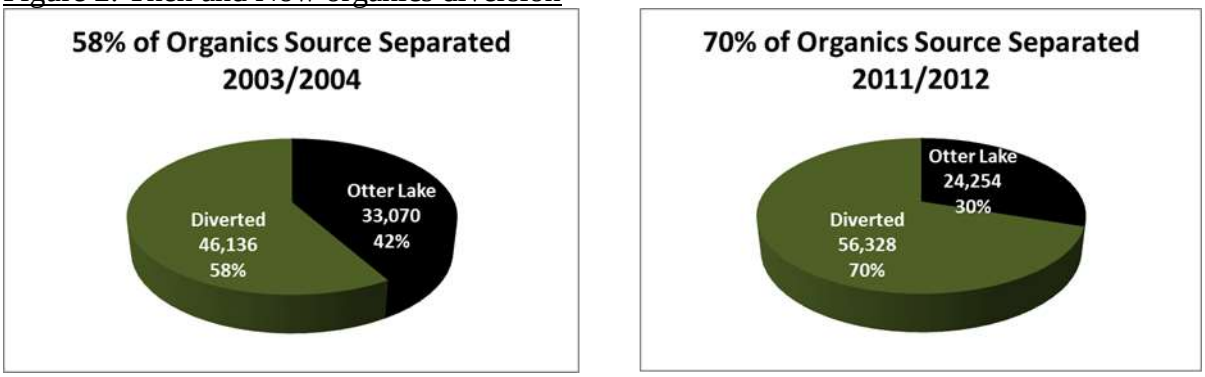
a. Maximize reduction, reuse and recycling of waste resources;
b. Maximize environmental and fiscal and fiscal sustainability of the waste program;
c. Foster public stewardship and conservation.

B. Organics Program

Successes

HRM's organics program is a sustainable success. In July, 2013, Statistics Canada identified HRM with a rating of over 93% participation in organics diversion, the highest for a city in the country.[22] HRM's innovative green bin program has spread across North America. As noted in the figure 2 pie charts below, HRM has continued to increase diversion of organics from landfill, improving 12% in the past 10 years.

Figure 2: Then and Now organics diversion



Challenges

Waste content analysis shows that almost 25,000 tonnes of putrescible organics remains in the garbage stream being delivered to Otter Lake landfill. Proper diversion of this material will require development of alternative processing capacity and/or program changes.

Current SSO collection and delivery of organics from residents and the ICI sector exceeds existing HRM infrastructure processing capacity. HRM's two in-vessel aerobic composting plants have an annual combined capacity of 48,000 tonnes. HRM currently receives over 51,000 tonnes. HRM contracts for excess organics materials to be sent to an outside of jurisdiction processing site. In addition, HRM contracts for separate extra leaf and yard waste (LYW)

[22] EnviroStats: Composting by households in Canada, *by Iman Mustapha*, Environment Accounts and Statistics Division, July 2013, http://www.statcan.gc.ca/pub/16-002-x/2013001/article/11848-eng.pdf, 3 January, 2014.

collection during spring clean-up and fall leaf collection periods. There is also a separate Christmas tree collection contract.

In 2005, the Canadian Council of Ministers of the Environment, CCME, implemented new compost guidelines to govern municipal SSO programs and processing. The 2005 guidelines are currently in effect. HRM has until 2015 to meet those guidelines through implementation of system and program changes. HRM is required to submit a plan by January, 2014.

HRM's current aerobic compost processing plants in Burnside and Ragged Lake are at capacity. System performance analysis identified that the inclusion of ICI organics introduces problematic high moisture content materials into the aerobic process. The aerobic process was not designed for this type of high moisture content materials. The combination of residential and ICI organics in HRM's SSO program results in a CCME 2005 guideline compliance challenge.

The Burnside plant has made progress through capital improvements over the past 18 months and the current assessment is that the plant meets the updated guidelines. This is being tested for confirmation. Compliance testing is on-going at the Ragged Lake site. HRM has notified NSE of the assessed compliance of one plant and requested a delay in submitting a plan for the second while the ISWMS program review is on-going.

HRM's end product compost has never lived up to program or CSC Strategy expectations. HRM's phase one material from the processing plants goes to secondary sites for open windrow finishing, making it suitable for sale and use in landscaping applications. Due to the level of contamination and poor quality, there is no revenue return on HRM's current compost program. The CSC Strategy envisioned revenue generation from the organics program to offset system costs. Factors affecting organics quality include:

- Contaminants in the residential green-cart collection materials, including glass, rocks, plastics and other banned materials;
- Contaminants in the ICI materials, including plastic utensils, straws, and other banned materials;
- Plastic bag shreds resulting from plastic bags ending up in the green carts and ICI organics. These bags introduce shreds of plastic film into the compost product during initial processing and are very challenging to remove and unsightly in terms of finished compost;
- Grass clippings, which introduce odour and processing challenges from materials which is now commonly just left on lawns.

Opportunities

Analysis of municipal SSO programs that include ICI organics indicates that anaerobic digest (AD) processing is far better suited to deal with ICI organics. There are several operational technologies in urban settings processing ICI organics. AD processing also produces a methane gas which can be used to generate renewable energy and revenues. AD technology systems capable of dealing with ICI organics are costly systems. A new project in Toronto cost $70 million. An alternative to the costly large scale ICI AD plant is the evolving option of on-farm

AD processing.

HRM has no legislative obligation to support ICI organics processing. However, there is currently no alternative ICI organics processing option within HRM. HRM currently subsidizes the processing cost of $160.00/tonne based on a tip fee of only $75.00/tonne. This equates to $1,367,820.00 per year in subsidization. Introducing higher service costs to the ICI sector could have a negative effect on HRM's ISWMS objective of diverting organics from the garbage stream and landfill.

The following options could address HRM's program requirements:

1. Issue an RFP for design/build/own or operate project to develop an AD capability to support ICI organics processing. An industry confirmed rough order of magnitude (ROM) assessed cost of this project is approximately $25 million. A business case would have to be developed to confirm per tonne tip fees costs to repay this capital investment;

2. Notify the ICI sector that as of a set date, ICI organics would no longer be accepted at HRM compost processing facilities. The ICI sector would be responsible to develop a private sector option to accept their organics materials. This could include a new site(s) or expansion and/or new arrangements with existing processors. A private sector option could result in a higher tip-fee for ICI organics which could be a negative impact on HRM diversion from landfill.

3. Partner with an existing contractor for the development of an AD capacity, either at a new site or at an existing site. An existing site would need modifications but also reduces capital investment from use of existing scales and other infrastructure.

4. Capitalize on a growing effort to establish on-farm AD processing in NS. There are currently two systems in development within reasonable proximity to HRM. This capability introduces the opportunity of a hybrid organics solution incorporating option 3, utilizing an existing compost plant as a transfer station to pre-process HRM ICI organic slurry for tanker transfer to area on-farm AD processing sites. This option encourages development of private sector ICI organics processing capacity. Viability depends on confirming adequate additional on-farm AD processing capacity to handle HRM's ICI organics tonnage.

Consultation Feedback

Current ICI organics tonnage and composition negatively affects HRM's SSO organics program. Consultation input identified improving the quality of HRM's organics compost as a desired system outcome. Improving compost quality is consistent with CSC Strategy objectives and Regional Council priorities and direction.

Consultation outcomes important to residents included:

- A marketable compost product at a reasonable price

- Ease of participation
- Focus on backyard composting (BYC)
- Increased education and enforcement
- Increased participation from apartments and condos
- Production of a category B compost product from the WSF at Otter Lake

Tensions and Trade-offs:

- Cost
- Weekly pickup for part of the year (April through October)
- Durability of paper bags for LYW
- Concern with rodents associated with BYC

Consultation feedback from Industry and the ICI sessions was consistent with resident feedback:

- Reduce contamination, reduce system and service costs, and improve education.

Analysis of kraft paper bags verses plastic for LYW collection programs supports mandating kraft paper and banning plastic. System data from PEI, Fredericton, NB, City of Brockville, Region of Waterloo, North and West Vancouver, Ottawa and Hamilton includes:

- Strong support and recognition that kraft paper bags significantly reduces compost contamination from plastics/residual plastic scraps from shredding and improves compost quality
- Higher degree of decomposition than bio-degradable plastic bags through standard urban composting systems
- Equally robust as plastic for standing up to weather conditions in the Maritimes
- Price comparable once established in the market place as the required option
- More acceptable than plastic bags as visible materials in end state organics compost

Separately collected LYW could be sent to open windrow processing sites rather than utilizing costly in-vessel composting plant capacity. Open windrow composting costs significantly less that the current in-vessel processing.

- $160.00/tonne overall system cost of HRM aerobic organics processing;
- $28.55/tonne for separate LYW processing in 2013 {$56,500 for 1,979 tonnes}

In order to achieve outcomes identified through the system review process, output from HRM's aerobic composting plants (phase one SSO) would optimally go to a contracted partner site for final curing. Such a future contract would include return of HRM compost for distribution and/or sale to residents.

The above-noted hybrid system incorporates the following program changes and investments:

- Investment in ICI organics slurry receiving and initial processing for transportation to on-farm AD processing

- Collection program changes for separate LYW
- Changes in phase two processing options
- Reduced program costs based on separate LYW, separate ICI processing and improved quality of residential aerobic processing and end state compost

The hybrid opportunity includes: an introduction of on-farm AD processing for ICI organics and requires refinement into a full business case analysis for Regional Council consideration. Full business case (BC) analysis will include:

- Development of a refined site investment project plan to support receiving and initial processing of ICI organics for transportation to alternative AD sites;
- Confirmation of regional site options for various processing capacities;
- Letters of Intent (LOI) for partnerships to confirm AD processing capacity and phase two processing of residential SSO;
- Validation of HRM's capacity requirements for processing SSO;
- Validate green cart size given content changes but maintain environmental stability and robustness (wind, rodents etc…) for replacement procurement;
- Expand weekly collection of organics from spring through late fall (April through November) for all residents.

Table 3 below outlines organics program system costs based on system requirements. These include estimated costs to modify existing infrastructure and programs as outlined to achieve the hybrid solution option.

Table 3

Compost Facilities

	5 Year Estimated Cost 2014/15 - 2018/19	11 Year Estimated Cost 2014/15 - 2024/25
Revenues	-$ 7,371,000	-$ 19,115,000
Expenses	$ 55,754,000	$ 160,963,000
Net Cost Operating	$ 48,383,000	$ 141,848,000
Savings From Program Adjustment	-$ 8,500,000	-$ 23,500,000
Amended Net Operating Cost	$ 39,883,000	$ 118,348,000
New Capital	$ 8,500,000	$ 8,500,000
Total Cost	$ 56,883,000	$ 150,348,000

All figures are based on the 2013/14 year end forecast increased annually by the 10 year average increase.
Capital costs of program changes is built into the annual operating payments as is the current practice.

Note: The $8.5M new capital is for a secondary compost site at $3.5M and increased organics

processing capacity at $5M. This model includes changes to the existing contracted operations and resulting forecast program savings. Collection cost adjustments were not included. New infrastructure costs have been identified in terms of potential future system costs. Infrastructure development requirements can be met through public or private RFP funding of capital projects. Full business case analysis will determine the appropriate mechanism to meet the organics infrastructure requirements.

Recommendation #2 re: Organics

Development of a business case for the source separated organics program to introduce an Anaerobic Digestion processing capability and other program changes to improve system cost performance and compost quality and return to Regional Council with a revised plan by 30 June, 2014.

Recommendation #3 re: Organics

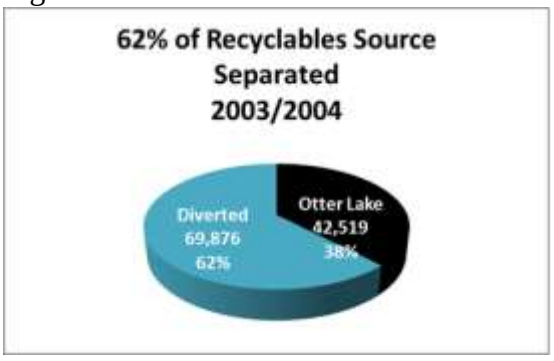
By-law amendments to improve organics collection, processing and finished compost product quality for residential SSO and enable redistribution to residents by a) removing box board as a mandated green bin product {while still permitted as a kitchen scrap material catcher} and b) mandating use of kraft paper bags for separate collection of leaf and yard waste, and c) banning grass clippings from LYW collection.

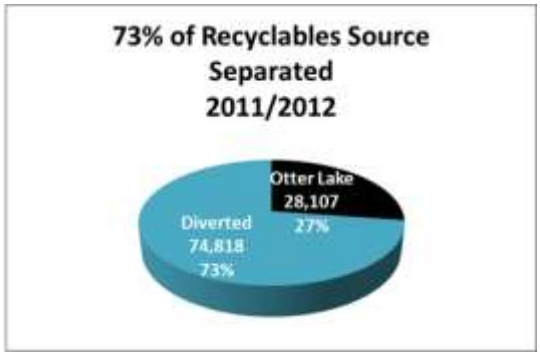
C. Recycling

Successes

HRM's recycling program is doing well. As noted in figure 3 below, in 2003/04 recyclables diversion was at 62%. Current recyclables diversion is over 70%.

Figure 3





In addition, HRM's multi-stream model that separates containers into the blue bag, newsprint and computer/commercial paper into its own stream and corrugated cardboard into a third steam has provided for low contamination and high revenues. Revenue from marketing of recycling materials almost covers the total processing cost of the materials. Operating costs {when all costs

and revenue is included) vary between a low of $15.00/tonne to an average high of $54.00/tonne depending on market prices for the recyclables.

Challenges

As with organics, there remains over 25,000 tonnes of recyclables in the garbage stream. This material needs to be included in analysis of program requirements for recycling. This material also represents revenues not offsetting program costs. However, of note, in the case of recycling program, data shows that once a program reaches 35,000 tonnes, it is practical to examine single stream recycling.

HRM currently does not charge a tip fee to the ICI sector for recyclables. This approach reflects a program policy objective to encourage source separation and diversion from landfill. However, this means that the ICI sector delivers the low revenue return materials to HRM processing site for free, and HRM pays for the processing and the ICI sector delivers the high revenue materials to private sector paper and fibre processing sites. The private sector processing sites will pay for the high value fibre paper and cardboard received, based on market prices. As previously noted, the private sector processes over 40,000 tonnes/year.

Should HRM decide to develop a single stream recycling program, a percentage of the ICI recycling tonnage should be included in the system model analysis. It is possible, given the system convenience of a single recycling bin, that some ICI businesses could send all their materials to HRM's Materials Recovery Facility (MRF). This business case requires refinement in terms of HRM MRF capacity needs and opportunity.

HRM's MRF was commissioned in 1991 and is approaching its end of functional life (usually 25 to 30 years).[23] Although the plant has undergone several capital investment processing improvements since commissioning, the processing technologies and machinery are largely out of date in terms of industry advancements and recycling standards. HRM is manually screening and processing several types of products which are now predominantly processed by automated systems.

The current MRF facility has limited protected storage capacity which stresses the site as tonnage continues to rise. The current property does not support expansion of the footprint to include additional covered external storage area. The neighbouring lot is a storm-water retention area and not developable. So, even if HRM were to add additional shift processing hours, the site would be challenged to support the additional processing in terms of protecting the processed bailed fibre and paper materials.

The MRF's current contracted processing capacity is 28,000 tonnes/year. Annual collection and processing of recyclables is 26,000 tonnes. This includes one contract for processing materials generated outside HRM from a neighbouring municipality. HRM has also been asked to consider materials from a second neighbouring municipality. Regionalization and support to other jurisdictions poses both challenges and opportunities for HRM.

[23] Stantec, Waste Resource Strategy Update, January, 2013, page 6.1

MRF marketing revenues are variable in terms of market supply and demand. HRM is further challenged by the fact that most material recycling production facilities are located outside the Maritimes. Transportation costs from HRM to Ontario markets are a negative factor on HRM recycling revenues. Identifying new markets and capitalizing on HRM's port logistics supply chain position offer new opportunities as HRM's system evolves. This includes new recycling technologies coming into operation, which include plastics processing and other waste to fuel technologies.

Opportunities

A new MRF will enable HRM to benefit from significant advancements in technology used to process, sort, screen, and manage recyclable materials. Single stream verses multi-stream recycling continues to be a contested debate. Data supports both models. Automated screening and sorting technology has advanced to the point where recycling materials in a single stream program can be as cost effective as multi-stream systems. The issue remains the degree to which the single stream automated systems can reduce cross material contamination. Contamination was traditionally a negative impact for single stream systems where broken glass and other contaminants reduced the market value of materials collected.

New screening and processing systems reduce contamination and produce marketable materials which can improve single stream revenue returns. Single stream systems have proven to generate higher participation and capture rates than multi-stream systems through the convenience of a single receptacle or bin. Potential revenue loss can be partially offset through higher participation and capture rates and greater efficiency in collection programs. However, residue rates (materials that in the end are sent to landfill following rejection in the MRF) do increase with single stream over multi-stream processing. The counter is lost revenue from this higher residue rate.

Glass in the recycling stream requires examination. Glass introduces negative impacts on recycling materials and has minimal recycling options and value. Broken glass contaminates paper and fibre and other recycling streams. With minimal residual value and negative impact on the recycling process, especially in single-stream systems, glass may more appropriately be returned to the garbage stream as an inert material for landfill.

Any use of glass, be it road construction, septic fields, landfill cover etc…, will still require glass to be processed through the recycling stream because it would need to be sorted and processed for other use. Another option could use recycled glass as part of a daily cover mix for landfills. Environmental stewardship for products needs to include all impacts of recycling materials, not just diversion from landfill. Recycling systems need to validate the cost, energy and implications of all included materials being processed. It may be more environmentally prudent to remove glass from the recycling than expend energy and resources in recycling.

In 2011 HRM added all plastic containers to its blue bag program (except Styrofoam). This has resulted in additional plastics being diverted from the landfill for recycling and made program participation easier for residents. The "mixed plastics" product has a lower yield revenue rate of return then other higher value plastics such as HDPE and LDPE plastics. However, the industry

is evolving and there are a number of new technologies which are vying for this mixed plastic material stream which may represent future opportunities for new revenue for HRM's program, further reducing processing costs.

New technology processes can reduce plastics back to their fossil fuel base elements. This is a proven technology currently in operation. The proponents who have contacted HRM are at various stages of their business case development. HRM is well placed to support the sale of plastics to these proponents to improve recycling system fiscal performance. However, there is a limited quantity of plastic products. Determination of the best partner will come down to an RFP process to identify the most beneficial relationship for HRM.

Industry data indicates that the recycling program fiscal performance could be further improved with the introduction of automated collection using large blue carts rather than blue bags. A cart based system is generally associated with single stream recycling. There are a few jurisdictions utilizing split carts. However, there is industry concern for the practicality and cross contamination outcomes of split carts.

Introduction of blue carts would likely be made in conjunction with a recommendation to change from multi-stream to single stream recycling. Automation, both in collection and processing reduces long-term system costs. However, multi-stream systems have greater revenue returns and market protection based on higher quality materials. In volatile market periods, as was witnessed during the crash in 2008/09, single stream recycling materials can become very hard if not impossible to market which negatively impacts offsetting program revenues.

Alternative Technologies

Alternative technologies and their use of waste stream resources can bring added benefit to HRM's ISWMS program. Plastics to fuel, gas and chemical recovery systems and energy from waste systems introduce practical environmental stewardship alternatives to sending unmarketable resources to landfill. Establishing local options for recycling and including alternative technologies as part of the ISWMS regime could enhance HRM's revenue position in terms of system fiscal performance.

Recent industry literature suggests that market value is definitely a priority with the volatility of the recycling commodities markets. Furthermore, given the effort to educate citizen behaviours for multi-stream source separation at the curb, reverting to the single stream model would seem counter-productive and regressive. However, providing one cart to handle all materials has significantly improved participation and capture rates where a single recycling stream was adopted. From a system perspective, enabling all recycling materials to be placed in one cart addresses the desire to make the program easier and increase diversion from landfill. The counter is a potential increase in residue rates.

Recycling carts can be collected using various truck types, including semi-auto and auto loaders which reduce crew sizes and collection costs through improved efficiency. When delivered to the MRF, the materials are tipped and then moved through initial dynamic sorting systems to split the streams between containers, paper and plastic film. New screening systems remove

contaminants such as broken glass from the other materials. The use of a large recycling cart could provide better protection from the environment as compared to the separate paper and cardboard practices currently in use. However, recycling materials are light so cart size and stability would have to be validated.

The introduction of blue carts would require an extended planning period. Program changes would include:

- A new single-stream MRF which would require approximately 18-24 months for a design/build/operate project. A new MRF facility could be funded through public or private capital with different operating models. This would be determined through a full business case cost benefit analysis process.
- Potential changes to collection truck specifications will require issuance of a new collection RFP which stipulates what truck configuration will be required to be capable of supporting blue carts.
- The procurement, distribution and education of a new blue cart system will also take careful planning.

Industry data supports the following hybrid model as an optimal model for recycling:

- automated or semi-automated collection of carts for recycling;
- automated processing in a single stream MRF which can accommodate multi-stream materials with a bypass;
- material screening to minimize contaminants to sustain marketability of materials and revenues.

A single stream cart based collection and automated MRF system means:

- Carts that will increase capture rates and participation as compared to HRM's current bag program.
- MRF automated screening and sorting technology with improved protection from material contaminants.
- Carts that will reduce MRF processing costs – less labour to remove bags, improving MRF throughput/production per hour.
- New sorting and processing technologies that should reduce typical residue rates.
- A MRF processing set-up to minimize cross-contamination on each processing line (paper & containers) – having the materials arrive at the MRF loose will allow sorter systems to efficiently remove paper materials from containers and vice versa. New MRFs are designed to better accommodate cross contamination with combined pre-sort areas, recirculated Quality Control conveyors, etc…

Other implications from a single-stream / automated MRF include:

- Reduced impact from cross-contamination of materials in bags which holds up processing lines and makes it difficult to separate materials efficiently.
- Industry supplied data indicates bags increase processing costs per incoming tonne of recyclables when all MRF costs are accounted for (less MRF labour, higher MRF throughput, less MRF residue, less MRF paper/container cross-contamination, higher MRF materials revenue).

- Plastic bags collection programs negatively affect system performance of a MRF.

Consultation Feedback

Consultation feedback was mixed on recycling. There was consensus that HRM needed to provide more education, monitoring and address the challenges with apartments and condos. Feedback also identified making the system easier as a priority. Members of the community who participated raised concerns about dealing with another large cart should the program introduce blue carts rather than the current blue bag system. There was also concern raised about reducing the quality of the materials as a result of moving to single stream rather than the current multi-stream program.

Table 4 below outlines identified system and program costs going out to 2024/25.

Table 4 - Recycling Program Costs Analysis

Material Recovery Facility

	5 Year Estimated Cost 2014/15 - 2018/19	11 Year Estimated Cost 2014/15 - 2024/25
Revenues	-$ 10,516,000	-$ 25,687,000
Expenses	$ 17,167,000	$ 41,724,000
Net Cost Operating	$ 6,651,000	$ 16,037,000
Capital - New MRF	$ 10,000,000	$ 10,000,000
Total Cost	$ 16,651,000	$ 26,037,000

All figures are based on the 2013/14 year end forecast increased annually by the 10 year average increase.

It is estimated the operating costs and revenue generated within a new MRF will be consistent with past trends.

Note: New infrastructure costs have been identified in terms of potential future system costs. Infrastructure development requirements can be met through public or private RFP funding of capital projects. Full business case analysis will determine the appropriate mechanism to meet the infrastructure requirements.

MRF Replacement Timeline

There are various models HRM could employ to replace the existing MRF. HRM could invest taxpayer funds through an RFP process to develop its own MRF as with the current facility and then contract out for its operation. Alternatively, HRM could RFP for a proponent to develop a MRF and pay on a per tonne basis for processing. There are multiple variations of the design/build/operate/maintain models for this type of project. The business case will include cost benefit analysis of the return on investment comparison and long term system cots between a pay per tonne verses own and operate model.

Based on a 24 month project timeline, and a one year RFP process, the following is a timeline for a MRF replacement project.

- FY2016/17 – Approve $10 million capital project (funding source to be determined)
- FY2017/18 – Conduct RFP process for new MRF
- FY2018/19– Execute new MRF project
- FY2019 – Commence new MRF operations.

HRM will require a new MRF to support the recycling program and system growth. Regional partnership opportunities also exist. The recycling program also affects the collection program in terms of single verses multi-stream recycling. Staff intend to return to Regional Council within a year with a full business case to support evolving the HRM recycling program to include an optimal model of:

- approval for an RFP for a new MRF project = $10 million
- approval for an RFP for procurement of new blue carts = $13 million
- a new collections regime RFP

D. Household Special Handling Waste (HSW)

Successes

HRM has one permanent HSW depot which operates on Saturdays behind the MRF in Bayer's Lake. It is open approximately 42 Saturdays per year. In addition, HRM conducts up to four mobile events at other locations across the municipality. Figure 4 and table 5 below show a comparison of what is captured through the HSW depot and mobiles as compared to what is captured through processing at Otter Lake (FEP/WSF).

Figure 4

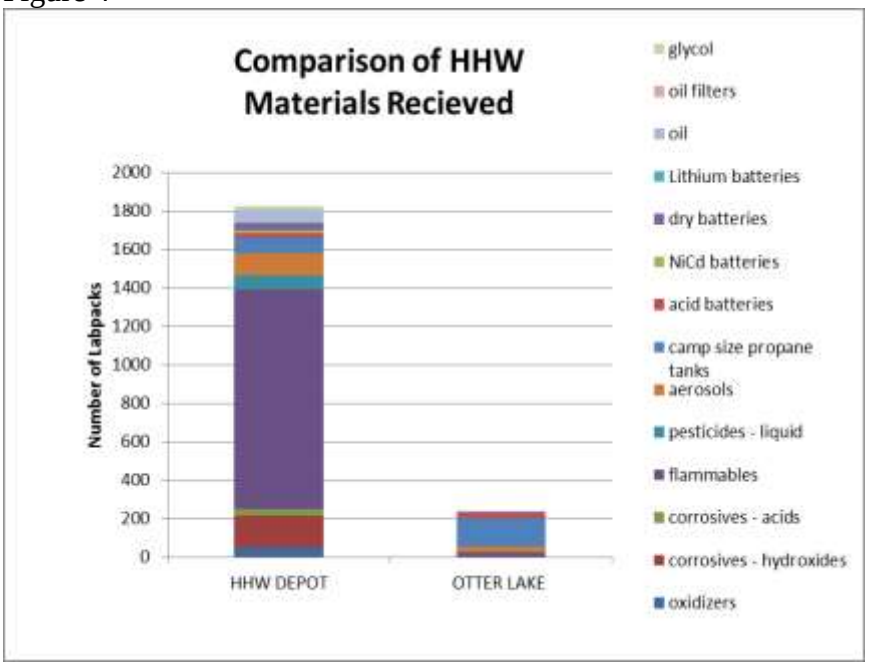


Table 5

Comparison of HSW Materials Received (B)				
	Acid Batteries	Fire Extinguishers	Propane Tanks	Paint (cages)
HSW Depots	550	0	1966	319
Otter Lake	183	256	316	0

Challenges

2012 system analysis shows the single permanent HSW depot, located in Bayer's Lake, received approximately 8,100 vehicle visits during the 45 Saturdays it was open for operation. In addition, HRM conducted three mobile HSW events with approximately 1,500 additional vehicle visits. In 2011 vehicle visits to the permanent depot numbered some 8,200 cars, with a further 1,900 vehicles at mobile events. Data from Otter Lake shows minimal recovery of HSW materials as compared to that from the Bayer's Lake depot and mobile events.

In terms of a municipality of 400,000 people, voluntary drop off by 9,600-10,100 vehicles over a year would seem to be a low participation rate. However, capture rates at Otter Lake shows that minimal quantities of HSW are delivered to the landfill. This may indicate that many residents are storing their HSW materials at their homes.

Some special handling products are covered under Extended Producer Responsibility (EPR) programs. Paint and electronics utilize the Enviro-Depot network. There are other programs which use retailers which sell products and retain or accept the recovered used products, like used oil at gas stations or tires. EPR programs are intended to cover the complete 100% end of life cycle costs of the products involved.

Depot networks are funded by fees paid by consumers when they purchase products. The fees are then administered by an agency such as the Resource Recovery Fund Board (RRFB; tires, deposit beverage containers), Product Care (paint) and the Electronic Product Recycling Association (EPRA; electronics). These agencies establish their recovery model, in this case a depot or voluntary drop-off system, and pay the operating costs for the depots, transportation, processing and marketing of the captured materials.

Not all EPR programs in NS have a mechanism to provide funding to municipalities who must deal with the materials not voluntarily dropped off and captured at the depots. The RRFB beverage container program and the paint recycling program do provide direct funding back to municipalities. EPR programs in other jurisdictions include mechanisms to transfer payment to municipalities for additional materials not captured in the voluntary drop off program.

Another challenge with voluntary depot drop off programs is that certain groups in the community are disadvantaged by this model of recycling program including the physically challenged, elderly and economically disadvantaged who do not have their own means of transportation and/or are unable to bring their materials to depots. This demographic includes individuals living in apartments, often the most economically disadvantaged in society, who may be unable to participate in the beverage depot program for deposit refunds. When the HSW program is examined, given the nature of the materials involved, improved universal access needs to be a factor in evolving the municipality's HSW program.

Opportunities

The addition of a second depot will have a direct impact on program participation. Greater participation addresses HRM's objective of increasing diversion of HSW materials from landfill. Program costs would be:

- One depot - $360,000/year
- Two depots - $700,000/year (estimated)

Increasing HSW program capacity through a second depot and/or increasing depot hours of operation addresses the program objective of enhancing environmental stewardship. Fiscal system performance is affected by the increased program costs of adding a second depot. However, as EPR programs evolve under NSE administration, it is hoped that costs of delivering municipal HSW programs for materials covered under EPR programs will receive funding.

In terms of mobile events, HRM has traditionally supported up to four mobile events at various locations across the municipality per year. A new initiative gaining popularity in other jurisdictions is for an annual district HSW event, often hosted by the district councillor and incorporated into other community events. This model offers a managed event in each municipal district every year. Events would be planned in coordination with the local councillor.

- Current 4/yr. mobile event cost approximately $12,500/event
- 16 District events {taking into account economies of scale} could cost between $150-200,000/yr.

Based on the assessed levels of participation in the HSW program, new initiatives to get residents to clean-out basements, sheds and garages of HSW materials is a recognized program priority. The district event model is identified as an opportunity to gain program visibility, increase resident access and improve capture rates across HRM.

Consultation Feedback

Residents strongly supported expanding the HSW program. Local community members participating in the consultation sessions remain concerned about these materials continuing to end up in the landfill. A consistent theme through all public sessions and online feedback was for improving education and implementing measures to increase diversion from landfill. These objectives are consistent with program priorities and Council direction to enhance education and improve system environmental and fiscal performance.

In-person input and online feedback from the consultation portal identified new by-law measures to improve diversion from landfill and overall system outcomes. The following list of S-600 By-law amendments are aligned with the vision and principles of the original CSC Strategy and Regional Council's priorities and direction. Statistical data shows that these measures specifically target HSW materials while also increasing diversion of organics and recyclables.

Recommendation #4 re: HSW

Site a second household special handling waste depot and introduce annual district mobile household special handling waste events.

E. Residual Waste / Garbage

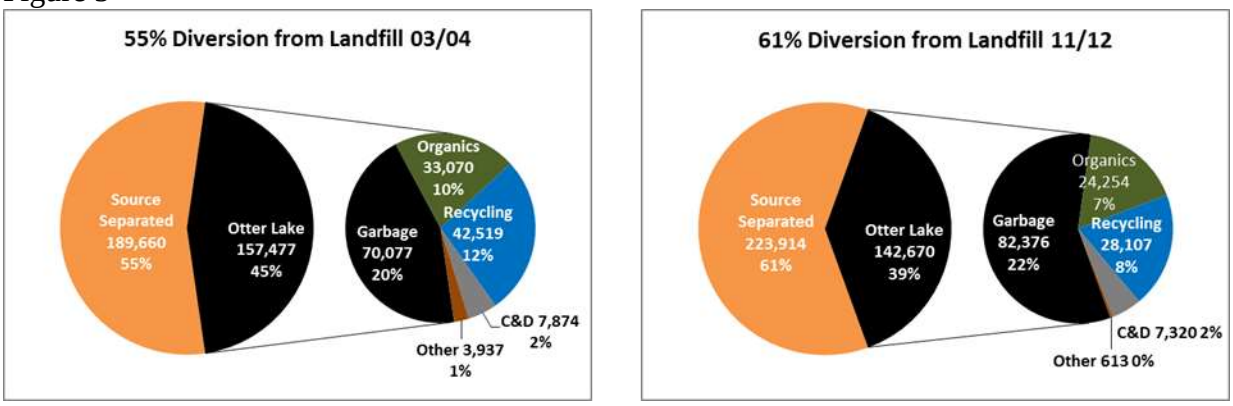
Successes

HRM can take pride in the fact that for the past seven years the municipality has reduced the generation of waste delivered to the Otter Lake landfill. HRM peaked in waste generation in 2005-2006.

- 1999/2000 – HRM generated 141,000 tonnes
- 2005/2006 – HRM generated 165,000 tonnes
- 2012/2013 – HRM generated 139,000 tonnes

Figure 5 below illustrates the waste stream breakdown between what was source separated and what was delivered to Otter Lake and the make-up of materials delivered to Otter Lake.

Figure 5



HRM's source separation program has been in place for over 15 years. In terms of broader ISWMS and CSC Strategy system objectives, progress has been made. As noted in the pie charts above, from 2003/04 to 2011/12, HRM reduced the amount of organics in the landfill waste stream by almost 10,000 tonnes. Recycling material was also reduced by over 10,000 tonnes. However, as also shown, there remains almost 60,000 tonnes which can be diverted from landfill annually.

Contributing factors to waste stream changes since 1995 include:

- Legislative Changes
  - Environmental Act
  - Environmental Goals and Sustainable Prosperity Act
  - Solid Waste Resource Management Regulations
  - NS Landfill Guidelines
  - NS Material Bans
  - By-law S-600
  - HRM Education/Enforcement

- Behavioural changes
  - source separation & green carts
  - source separation & blue bags, paper + cardboard recycling
  - program responsibility/ownership
  - consumer purchasing choices
  - back yard composting
  - reuse, reduce practices, weekend give-aways
  - recycling products through charities/donations

- Product changes in terms of:
  - reduced packaging
  - packaging changes (recyclable plastics verses glass and Styrofoam)
  - reusable bags

Challenges

Currently, 97% of materials delivered to Otter Lake end up in the landfill cell. This is the outcome of the change in the CSC Strategy objective to accommodate disposal rather than diversion. Otter Lake landfill operations currently cost $170.00/tonne as of construction of Cell 6. This includes operations of the FEP/WSF and at the Residual Disposal Facility (RDF or landfill cells), plus gas management operations, leachate processing and all capital expenditures for cell construction, closure and operating equipment.

When system costs were assessed in relation to the original CSC Strategy, analysis indicated a projected cost of $67.00/tonne (FY96).[24] This equates to $90.00/tonne (FY12) based on Canada CPI Inflation. When changes were made to the ISWMS plan they were based on keeping implementation and operating costs within the projected cost ranges of CSC Strategy projections.[25] The CSC Strategy model reduced landfill costs by reducing the requirement to build landfill cells through diversion, extending their life spans and the period used to pay for them. Current system costs are almost double what they were forecast to be when the ISWMS plan system changes were approved.

In terms of diversion, the FEP/WSF operating model was changed from diversion to disposal, with only limited diversion of readily managed and practical materials. The FEP/WSF operating plan states that hazardous materials identified on the tip floor are to be separated and sent directly to the landfill cells. Table 6 below outlines the actual tonnage of materials pulled off the processing line by the 40 staff who work in the FEP/WSF. The cost of that diversion is also noted.

Table 6

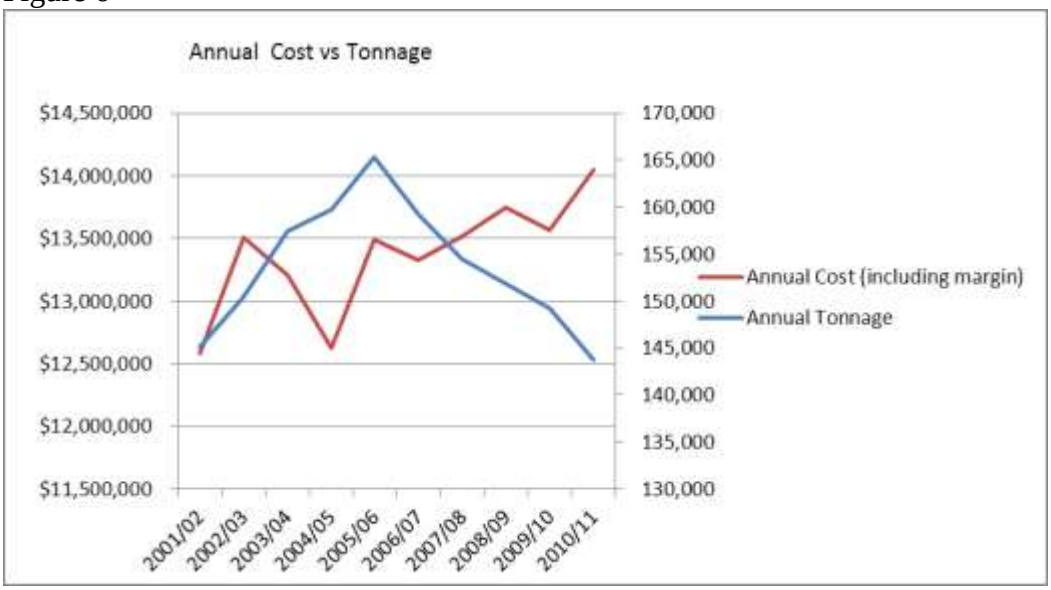
FEP/WSF System Performance & Cost				
Year/Overall HRM Diversion from Landfill	**Isolated FEP/WSF Operating Cost**	**Recyclable Materials Diverted from Landfill (Tonnes)**	**Percentage of Diversion From RDF**	**Cost Per Tonne of Diverted Material**
2004/54%	$ 7,200,000	525	0.5%	$ 13,700
2011/61%	$ 8,000,000	300	0.3%	$ 26,700

Figure 6 below illustrates how HRM's landfill costs have continued to rise as tonnage decreases (tonnage is currently holding around the 140,000 tonne/year mark in forecasts). Figure 6 shows the inverse relationship between rising landfill costs and decreasing garbage tonnage. The left

[24] An Integrated ~~Waste~~/Resource Management Strategy, Table 7-3, 1995.
[25] HRM – SWRAC 5 July, 1996, Revised Solid Waste/Resource Management Strategy Cost Projections, Revised Regional Solid Waste/Resource Management Plan May 1996, 2.July, 1996

hand vertical axis shows annual Otter Lake costs. The right hand vertical axis shows annual tonnages.

Figure 6



Private Investment Property Complexes

Private investment property complexes, high rise/high density, are included in the ICI sector based on being commercial properties assessed using commercial methods (based on revenue) although taxed at the residential rate. Condos are included with the Residential sector (those who receive curbside solid waste collection) because they are assessed as residential dwellings and taxed in the same or similar manner as houses, semis, duplexes, mobile homes, townhouses.

Overall, ICI diversion is over 60%. However, private investment property complex sector diversion lags well behind at approximately 30%. These complexes pose unique challenges as a result of tenant demographics and legacy waste infrastructure systems, which in some cases pre-date the current waste management program. HRM is engaged with the Investment Property Owners Association of Nova Scotia (IPOANS) in efforts to improve this outcome.

Compliance with By-law S-600 program guidelines is complicated in private investment property complexes as a result of environmental living factors including: multiple floors to transport waste; heavy or locked doors; convenient waste chutes; lack of education or signage; lack of storage space for source separation; and lack of practical methods of enforcement. It is further complicated by demographic and cultural factors: tenants rather than owners; students; cultural and language barriers of new Nova Scotian families and international students; seniors; and socio-economic influences.

Upon request from various property management firms during 2012/13, staff initiated pilot projects and tenant outreach education at several private investment property complexes across

HRM. These projects included direct outreach and education sessions, use of clear bags and provision of mini-kitchen green bins. The results have shown improved diversion and compliance outcomes at some apartment complexes. Project data also showed that improved diversion resulted in improved waste management service costs.

Private investment property complexes remain within the ICI sector. Integration of such complexes into the residential collection regime would underscore the municipality's commitment to addressing source separation and increasing diversion from landfill and put them under HRM service oversight and system monitoring. However, private investment property complexes would represent a challenge in terms of cost and program outcomes.

Incorporation of such complexes into the residential collection regime would result in the addition of approximately 50,000 units with uncertain results in terms of improvement in the extent of diversion. The additional cost of such integration based on existing condo waste modeling data is estimated to be anywhere from $4.7 to $6.8 million per year. It is recognized that tenant demographics are different between condos and investment properties. However, in terms of system analysis it was felt that this comparison would provide realistic data necessary to assess program implications. The collection of this sector would be put to an RFP and be subject to market pricing. This system cost does not include the additional resource costs to support this contracted collection regime and oversight work.

Integration of private investment property complexes into the residential collection regime would require the development of an implementation plan in conjunction with IPOANS and contracted collection firms. This option would generate some opposition from private sector haulers. There would need to be a transition period while the properties deal with their existing collection contracts. The increased scope of operations to manage, educate and monitor these properties would require additional staff resources. Assumption of the estimated $5 million annual additional program cost without identification of other offsetting program savings is not supported. Such a program change would require identification of current program savings to fund the assumption of this service cost from the private sector.

Flow Control

In 2002, HRM amended By-law S-600 (S-602) to ban the export of waste materials generated within the municipality and give HRM control over where materials were sent within the municipality. This measure was intended to protect revenues assessed as critical to support the ISWMS landfill and organics program costs. The NS Court of Appeal upheld HRM's position that it was entitled to control the waste materials generated within its jurisdiction to support waste program requirements.

Successes/Challenges

Flow control has not been a success. Analysis of flow control in HRM established that it is neither a fiscal nor environmental system performance benefit. In making this assessment, all system costs associated with each tonne of waste were included to assess overall system impact. The following is a straight forward tip fee verses cost impact comparison of flow control:

- 2002 – landfill cost/tonne = $135.00/tonne vs. tip fee of $115.00/tonne
- 2014 – landfill cost/tonne = $170.00/tonne vs. tip fee of $125.00/tonne

HRM's flow control mandates all garbage waste go to Otter Lake. Landfill system costs have and continue to exceed the charged tip fee. All waste materials delivered to the Otter Lake landfill utilize valuable cell capacity and result in the construction of cells every 40 months. Flow control further eliminates market competition for tip fees at adjacent second generation landfills for the business community and their contracted haulers while also imposing higher system costs on the ICI sector.

When examined in terms of overall system tonnages, changes to flow control could have a dramatic impact in terms of tonnage delivered to Otter Lake. Using an estimate of a 24% declining reduction in ICI residual garbage tonnage delivered to Otter Lake, eliminating flow control could result in less than 70,000 tonnes of waste per year being delivered to Otter Lake. In an estimated five years, this would enable doubling the existing cell life from 40 months to 80 months. This equates to system capital investment delays as follows:

- Current – Cell 8 $20M build in 2018/19, average allocation over 3 years is $6.6M
- Doubling Cell 7 life results in Cell 8 build in 2021/22, average allocation over 6 years is $3.3M
- Current – Cell 9 $21.5M build in 2021/22, average allocation over 3 years $7.2M
- Doubling Cell 8 life results in Cell 9 build in 2027/28 average allocation over 6 years is $3.6M

Opportunities

Flow control increases the tonnages delivered to HRM's landfill every year. Current tonnage results in the filling of one landfill cell approximately every 40 months. Cell 6 alone cost over $16 Million dollars to construct. Cell 7 is programmed at 19 million. Reducing tonnage delivered to Otter Lake would delay the requirement to construct the next cell. Delayed construction further allows for capital costs to be amortised over a longer period. This improves the environmental performance of the system without negatively impacting the fiscal system performance. Elimination of flow control represents two fiscal and environmental system performance opportunities:

1. Reducing tonnage delivered to Otter Lake conserves landfill cell capacity and delays construction of cells thereby delaying the environmental impact of constructing a new cell.

2. Removing flow control enables market competition for HRM waste materials, which should result in reduced service costs for businesses across the ICI sector.

All landfills in NS are governed by the same NS Solid Waste regulations and guidelines, and landfill liner specifications. Residual waste/garbage materials exported from HRM would only be delivered to other permitted and fully compliant landfills held to the same landfill environmental protection standards. Allowing waste to be exported to landfills outside HRM is not diversion. However, it does improve overall fiscal performance through:

- saving valuable Otter Lake landfill capacity and space,
- reducing landfill system costs by extending cell construction periods,
- reducing ICI organics delivered to Otter Lake which must be processed through the FEP/WSF,
- enabling waste resource exchanges, backhauling alternate loads further reducing system costs.

In addition to improving program fiscal performance, allowing export of residual waste/garbage also improves economic outcomes through:

- reducing ICI sector waste management service costs; and,
- supporting other regional landfill regimes.

Table 7 below shows a cost comparison by tonne of the current HRM regime both with flow control and without flow control. The two costs are essentially the same. In the "no flow control" regime, a reduced tonnage of 125,000 tonnes per year (from current 140,000) delivered to the landfill is used. The system costs are then calculated based on the existing price agreement with MIRROR NS to illustrate the comparison.

It is reasonable to assume that without flow control, given the lower cost of utilizing other landfills, (see Appendix 1, Table 20) more than 15,000 tonnes of ICI waste would be exported outside HRM. As noted previously, a 24% reduction in ICI tonnage delivered to Otter Lake results in an annual tonnage of 116,000. Table 7 illustrates that removal of flow control, and the corresponding loss in tip fee revenue is offset by the overall system saving of extending the life of cells and delaying cell construction.

Table 7

	Cost/Tonne at the landfill	Variable Cost – costs which fluctuate based on operations and tonnage	Fixed Cost – capital costs to develop cells
Status Quo with Flow Control	$167.00	$120.00	$47.00
No Flow Control at Cell 6	$170.00	$120.00	$50.00
No Flow control including Cell 7 (2015)	$175.00	$125.00	$50.00

Table 8 outlines the diversion rates across the waste streams as a result of implementing clear bags and eliminating flow control. This data does not include the transfer of disposed residual tonnage back to HRM by NSE from exported wastes to other landfills. However, based on the diversion measures, increased education, clear bags and bag limits, plus increased monitoring and compliance measures across the ICI sector, diversion should continue to increase even as residual waste is exported out of HRM.

Table 8

Clear Bag & No Flow Control Effect on the					
Projected Waste/Resources Received at HRM Facilities					
System Components	System Total 1st Year Forecast	System Total 2nd Year Forecast	System Total 3rd Year Forecast	System Total 4th Year Forecast	System Total 5th Year Forecast
Otter Lake	116,200	97,500	83,100	72,100	63,800
Compost Facilities	54,400	57,700	60,600	63,000	64,900
MRF	25,200	26,200	27,000	27,500	27,800
Fibres Private Recycling	43,400	43,800	44,200	44,600	45,000
Backyard Composting	5,000	5,000	5,000	5,000	5,000
Drop-off Materials	7,500	7,500	7,500	7,500	7,500
C & D	88,000	88,000	88,000	88,000	88,000
HSHW	500	500	500	500	500
Totals	340,200	326,200	315,900	308,200	302,500

Table 8 provides a forecast five year impact of removing flow control and implementing clear bags and a reduced residential bag limit in terms of materials delivered to Otter Lake. This assessment is based on a diminishing scale and the clear bag statistical data obtained from other jurisdictions. Analysis shows these changes could result in reducing waste delivered to Otter Lake below 70,000 tonnes per year within five years.

Table 9

Clear Bag & No Flow Control Effect on Waste Characterization at Otter Lake Waste Management Facility							
	Acceptable	Unacceptable					
Otter Lake	Garbage	Organics	Recyclable Paper and Cardboard	Recyclable Containers	C&D Material	Other	Otter Lake Total
1st Year Forecast	69,700	17,800	15,000	7,300	5,800	600	116,200
2nd Year Forecast	61,000	12,500	12,000	6,400	5,000	600	97,500
3rd Year Forecast	54,200	8,300	9,700	5,800	4,500	600	83,100
4th Year Forecast	48,800	5,000	8,000	5,500	4,200	600	72,100
5th Year Forecast	44,600	2,500	6,800	5,300	4,000	600	63,800

Table 9 data shows the dramatic reduction in organics delivered to Otter Lake based on removal of flow control and the implementation of program changes to enhance monitoring and compliance. In year 5, organics delivered mixed in with garbage is reduced to 2,500 tonnes. That equates to 3% of the waste materials delivered to Otter Lake. Current data indicates that over 5,000 tonnes/year of putrescible organics goes directly into the landfill without passing through the WSF. (See Appendix 7, figure 23)

Table 9 analysis indicates that the 30,000 tonne/year WSF facility would be processing less than 3,000 tonnes per year within five years. In addition to the functional performance outcomes of the current operating model outlined below, the above forecast waste stream changes of materials delivered to Otter Lake support re-examination of the operating model and the corresponding approximately $136.4 million cost of the operating model until 2024. See Attachment I – Financials for detailed breakdown of these costs.

A summary of the outcomes of removing flow control are:

- operating cost savings through reduced tonnage delivered to Otter Lake
- capital avoidance savings through extended useful life of cells
- economic benefits to ICI through lower costs of disposal, especially in view of assessed required HRM tip fee increases
- environmental benefits to HRM through reduced truck traffic, air and noise pollution
- exporting waste at market pricing to landfills to improve their fiscal performance
- economic benefits to other communities as a result of improved landfill program performance

Consultation Feedback

Participating residents expressed a consistent theme of frustration at the apparent lack of intent to hold apartment tenants and the ICI sector to the same source separation expectations as residents serviced through the residential collection regime. Other consultation feedback included:

- Strong support for increasing education and enforcement
- Increase monitoring and rejections
- Reduce system costs and improve fiscal sustainability
- Mixed support for reducing garbage bag limits
- Mixed support for clear bags
- Concerns on feasibility of and effectiveness of proposed changes

HRM conducted waste industry stakeholder and ICI stakeholder consultation sessions. Across multiple sectors and from several industry representatives, there was demand to examine the merits and justification for flow control of residual waste/garbage. HRM received direct input from several sectors (see attachments), which all speak to examining flow control and its' effect on waste management service and system costs.

- Investment Property Owners Association of NS (IPOANS) (Attachment D)
- Canadian Restaurant and Food Services Industry (Attachment E)
- Waste Management (Attachment F)
- Miller Waste Systems Ltd. (Attachment G)

Industry and the ICI sector were consistent in terms of supporting greater enforcement and education, especially with apartments. Industry stakeholders and the business community were looking for defined understanding and accountability in terms of implications of a clear bag system. Who was to be held accountable and how were rejections to be dealt with. The restaurant association did not support clear bags. Use of clear bags to monitor and manage source separation will require a detailed management regime be developed in consultation with the haulers and be incorporated into collection contracts.

Waste industry feedback recommended a separate collection regime for investment properties. Both the ICI and industry sectors did not want to move backwards but rather desired to build on existing successes with a view of holding costs in check.

In addition to reducing service costs, IPOANS identified incorporating high density residential properties into HRM's residential collection regime as a priority. Based on a national comparative scan, integration of apartments into residential collection regimes is a common practice in other jurisdictions of comparative size to HRM (Attachment H).

The consultation process identified strong support for practical changes which will enhance diversion from landfill, reduce system costs and improve private sector service delivery and costs. There was also intent to hold everyone equally accountable for the source separation model.

Recommendation #5 re: Residual Waste / Garbage (Flow Control)

Initiate By-law amendments to:

a. **mandate clear bags (with one nested opaque bag) for residential collections; and,**
b. **reduce garbage bag limits from 6 to 4.**

Recommendation # 6 re: Residual waste / Garbage (flow control)

a. **Increase curb-side education and monitoring;**
b. **Increase apartment tenant education and monitoring; and**
c. **Increase ICI load monitoring and inspections and the landfill.**

Recommendation # 7 re: residual waste / garbage (flow control)

Amend By-law S-600 to allow for the export of ICI residual waste (garbage) outside HRM, and amend Administrative Order number 16 to provide for an increase in fees for disposal of ICI residual waste from $125 per tonne to the assessed system cost of $170.00 per tonne.

F. FEP/WSF

The original CSC strategy viewed solid waste as a resource as opposed to garbage. The strategy relied on source separation or diversion to reduce reliance on landfill and achieve environmental protection. However, it was recognized that it would take some period of time to evolve the cultural change necessary to achieve the outcomes envisioned by the strategy. As such the strategy committed to the interim processing of residual garbage to divert organics and recyclable materials remaining in the black bag garbage stream while behaviours changed. The Front End Processor (FEP) and Waste Stabilization Facility (WSF) would divert improperly separated materials out of the landfill and capitalize on their value as resources. The resulting revenues would offset the interim processing costs

The CSC strategy envisioned that the FEP/WSF model would be "scaled down in a planned manner as source separated centralized composting scaled up."[1] Environmental and community protection were derived from behavioural change and source separation and the landfill cell liner designs and specifications. The mechanical FEP/WSF processing system was not intended as protection but rather to recover resources for revenue to offset initial system costs. Waste processing was not intended to provide long-term protection. Source separation based on behavioural change was the long-term solution.

The role of the FEP/WSF mechanical processing changed with the revised plan. The function changed from diversion to disposal; that is, minimizing the negative impacts from gases, odours, leachate and vectors resulting from organic and putrescible materials decomposing in the

[1] An Integrated ~~Waste~~/Resource Management Strategy, page 7, 1995.

landfill. [2] The contract with MIRROR NS included the design, construction and operational plan for Otter Lake, for which Provincial approval was required. However, there is no legislative requirement for the FEP or WSF and no other landfill in the province or identified in Canada or elsewhere, uses similar machine processing prior to disposal. This fact was noted by MIRROR NS when they submitted the revised plan and remains the same as noted by Stantec in their review. Unlike the green bin program, the FEP/WSF process has not been replicated anywhere.

Successes

The FEP/WSF facilities have performed as designed in the Revised Plan and contracted. They were developed to counter the negative environmental and community impacts resulting from putrescible food scrap organics supporting flocks of seagulls and other vermin, decomposing and creating odours and negatively impacting the environment and community and they have largely done that. In doing so, they have alleviated the concerns of the community. For some area residents, the FEP/WSF processing is identified as the source of community and environmental protection. Operational outcomes from the landfill site itself have met community expectations in terms of there being no environmental and community impacts. The landfill site does not support a large flock of seagulls. There have only been two brief periods of odour incidents, which were attributable to identified operational issues and addressed in a timely manner.

Challenges

There are four identified functional system challenges. These are:

1. Environmental impact of fugitive Green House Gases (GHG)
2. System Performance – Organics Capture Rate
3. System Cost Benefit Analysis
4. Occupational Health and Safety Issues

1. Fugitive GHGs

The proposed change from diversion to stabilizing prior to disposal was intended to achieve the environmental objective of minimizing the negative outcomes resulting from gases, odours, leachate and vectors. As previously note, MIRROR was not expecting fugitive gases to create problems at the landfill as a result of the FPE/WSF processing. The expected outcome from the processing of materials through the FEP-WSF was elimination of the negative environmental impacts of gases, odours, leachate and vectors.[4] Two years after operations began, in 2001, gases and odours began generating numerous complaints from neighbouring residents.

MIRROR NS developed a pre-closure gas and odour management system of temporary piping and wells to capture and flare off the fugitive gases escaping from the active cell. This fix currently adds approximately $750,000.00/year to operating expenses at the site. The cost of correcting this system failure is an on-going operational expense which is borne solely by HRM.

[4] Appendix Q, Operations Plan, Agreement For The Design, Construction And Operation Of Components Of The Halifax Regional Municipality's Solid Waste Facilities," page 21, dated July 25, 1997.

MIRROR NS recently commissioned a report by Dillon Consulting Limited, the engineering firm associated with the design and construction of the FEP and WSF. Dillon's position is that the FEP/WSF functions as contracted (in terms of duration and temperature of materials processed through the WSF) and that processing decreases the duration that resulting putrescible organics gases need to be managed.[5]

Dillon Consulting Limited commissioned an analysis from Dr. Paul Arnold who assessed the operation of the WSF and the materials coming out after stabilizing as follows:

"*The evaluation of the WSF demonstrates the facility is capable of significantly stabilizing the organic content in the residual waste stream delivered to the WSF, reducing the respiration rate (or in other words, the reactiveness or appetite for oxygen) by approximately 67% over the three-week treatment process. This reduction in the rate of oxygen consumption diminishes the subsequent decomposition that inevitably takes place in the Residuals Disposal Facility (RDF), thereby proportionately reducing the odour production potential and the corresponding production of liquid and gaseous by-products of anaerobic digestion."*[6]

Dillon and Arnold contend that the WSF functions as contracted and reduces the gas potential of the materials which pass through the facilities. However, the outcome of this process was not anticipated. Shredded and stabilized mixed waste organic materials, placed in an active cell, rapidly generate fugitive GHG that escape into the atmosphere. The temporary gas and odour management system manages the odours resulting from the processing.

2. System Performance – Organic Capture Rate

The FEP/WSF mechanical processing is intended to minimizing the negative impacts from gases, odours, leachate and vectors resulting from organic and putrescible materials decomposing in the landfill by stabilizing the waste prior to disposal in the landfill. The MIRROR NS currently employs 40 personnel in this function.

Statistical data from waste content analysis by both CBCL and SNC Lavalin shows that one third of the putrescible organics (2011) which are delivered to the FEP/WSF facility are sent directly to the RDF landfill cell without passing through WSF stabilizing.[7] (See Appendix 7, Figure 23 for the detailed breakdown of this analysis). This outcome is contrary to the MIRROR NS contract and also the CMC agreement. The MIRROR NS contract stipulates that all putrescible organics must be stabilized in the WSF prior to being placed in the landfill. These organics go straight to the RDF. The CMC agreement requires that only "acceptable waste" be deposited in the landfill. These putrescible organics bypassing the WSF are not acceptable waste. In terms of

[5] Waste Resource Strategy Update Document Review Report, May 2013, Procured by MIRROR Nova Scotia, Submitted by: Dillon Consulting Limited, page 11.
[6] Memo, Subject: Waste Stabilization Facility (WSF) Evaluation and Comment on Stantec Inc. & SNC-Lavalin Inc. Reports, *Bio-Logic Environmental Systems, Dr. P Arnold, 16 September, 2013*
[7] CBCL Ltd. - Otter Lake WSF Materials Characterization and Testing (Dec 2012 – Jan 2013) determined that 66% of the material processed through the WSF is organic and 34% is other material.

system performance, a significant percentage of putrescible organics enter the landfill without stabilization. The status quo situation is not compliant. However, notwithstanding this, the operational measures at the RDF currently in place at the landfill are effectively dealing with these putrescible organics that are not stabilized through the WSF.

3. System Performance – Cost/Benefit Analysis

The contract with MIRROR NS including the operation of the FEP/WSF and landfill is a no risk, total cost plus percentage of cost profit agreement. For every dollar MIRROR NS spends operating the landfill, HRM pays MIRROR NS that dollar plus an additional $0.25 in profit.

Table 10 outlines the projected system costs of the FEP/WSF over the next ten years:

Table 10

Projected Isolated FEP/WSF Capital Equipment and Annual Operating Cost Estimates			
Year	**FEP/WSF Operating Cost**	**FEP/WSF Capital**	**Total**
2013/2014	$8,500,000	$1,600,000	$10,100,000
2014/2015	$8,700,000	$1,300,000	$10,000,000
2015/2016	$9,000,000	$900,000	$9,900,000
2016/2017	$9,200,000	$1,600,000	$10,800,000
2017/2018	$9,400,000	$1,600,000	$11,000,000
2018/2019	$9,700,000	$1,900,000	$11,600,000
2019/2020	$9,900,000	$2,500,000	$12,400,000
2020/2021	$10,100,000	$2,100,000	$12,200,000
2021/2022	$10,400,000	$1,300,000	$11,700,000
2022/2023	$10,700,000	$1,300,000	$12,000,000
2023/2024	$10,900,000	$1,300,000	$12,200,000
2024/2025	$11,200,000	$1,300,000	$12,500,000
Total	**$117,700,000**	**$18,700,000**	**$136,400,000**

4. Occupational Health and Safety Issues

The MIRROR NS operating plan specifies sharps including biomedical waste hazardous materials when identified on the FEP tip floor shall be separated from the other residual materials and sent directly to the landfill cells.[8] This includes sharps, and all biomedical waste

[8] Approval, Province of Nova Scotia, Environment Act, S.N.S. 1994-95, c.1, Holder HRM, approval number 2008-065580-A01, expiry date July2, 2022, section 4 c 2 i & 5 e through i.

and all hazardous materials identified through inspection on the tip floor. This is an Occupational Health and Safety measure.

Medical waste is not classified as garbage, and when generated in a hospital is treated as special waste and not sent to the landfill. However, the growth of "at home health care" is a growing issue for the existing operating model at Otter Lake. This program has introduced what has always been identified as medical waste into the municipal waste stream. The Health Department has recently determined that some materials generated in a home as a result of "at home health care" be classified as garbage and be placed in garbage bags. HRM is concerned about this position, and waste identified as medical waste will be stickered and rejected.

As a result of the use of black bags for garbage in HRM, generated at home medical waste can be hidden within the garbage bag and not be identified until it is at the landfill. This medical waste could burst from a black bag being compacted in the back of a packer truck, or if run over by a frontend loader in the FEP. Of greater risk is the FEP processing which includes mechanically and manually ripping open black bags and exposing the contents prior to the materials being sent through the trommel screen and shredder before inspection by the second processing line of workers. The presence of this medical waste in the municipal garbage stream poses a potential Occupational Health and Safety risk for HRM's waste system workers. This OHS issue is magnified in HRM given the current use of black bags and the operating model at Otter Lake.

The negative environmental outcome of fugitive GHG, the continued reliance on processing of wastes, system performance, the significantly higher costs of the current landfill operating regime and the identified OHS issues are system challenges and outcomes unintended and contrary to the original vision and objectives of the citizen based CSC Strategy.

Opportunities

While the FEP/WSF facilities have performed as designed in the implemented ISWMS plan, the engineering and financial information indicate that they only contribute marginally to environmental protection and do so at a very significant cost of more than $10,000,000 per year. Further, that cost continues to rise notwithstanding that diversion of waste at source has continued to increase and volumes of residual waste processed by the facilities have continued to decrease. As such, there is an opportunity to use other methods to increase diversion (such as clear bags and removing flow control) and other measures at the landfill face to enable the scaling back, discontinuance or even repurposing of the FEP/WSF facilities, and thereby maintain environmental protection while realizing significant savings.

Stantec and SNC Lavalin both concur that given the current contents of the garbage waste stream, other measures could maintain exiting environmental and community protection. SNC Lavalin went so far as to suggest that given the amount and nature of organics currently arriving at the Otter Lake site; "*In our opinion, the WSF process contribution to minimizing the number of reported annual community odour incidents is such that if it did not exist, it would not be*

missed, due to the demonstrated management infrastructure, capacity, and operations at the RDF."[1]

Stantec and SNC Lavalin are not suggesting that the FEP/WSF does nothing. On the contrary, both firms agreed with Dillon and Arnold that the facilities do reduce gas potential in the stabilized putrescible organics. What Stantec and SNC Lavalin are suggesting is that other measures, operational initiatives and processes undertaken at the active cell and on the RDF itself could achieve the same results as the current FEP/WSF operation. More importantly, these same results could be achieved for significantly less cost. At a current annual assessed cost of over $10 million/year over ten years, FEP/WSF system costs would support most if not all other ISWMS infrastructure investment needs.

Consultation Feedback

Town hall and community outreach consultation events featured very emotional sessions. Every public session was attended by many residents of Beechville, Timberlea, Lakeside and Prospect Road (BLTPR), MIRROR NS and Municipal Group employees, the CMC and engaged stakeholders. Overall consultation feedback, including online input, identified:

- Strong opposition to any changes to the Otter Lake operating model, facilities or landfill design.
- Strong support for exploration of alternative technologies rather than landfill for waste
- Mixed reaction to a ISWMS campus at the Otter Lake site

Outcomes most important to residents, especially those in attendance at most events:

- *Honour the contract*, referring to the MIRROR NS contract and CMC agreement
- No reduction of the landfill liner
- No increase in cell height
- No waste campus
- HRM to site a new landfill and close Otter Lake in 2024

The ICI sector and Industry breakout sessions were also dominated by MIRROR NS and Municipal group employees. Key takeaways from these sessions included:

- Lower waste system costs
- Cost effective programs which meet environmental objectives
- Must consider impact on community of changes at Otter Lake
- Change the HRM By-laws to allow export of materials
- Increase monitoring and education of apartments and condos
- Single stream recycling would streamline recycling
- Need clear understanding of service cost implications of any system changes

[1] A Peer Review of the January 2013 Stantec Report for HRM titled "Waste Resource Strategy Update," SNC Lavalin Inc., Version 1.0, page 58, April 2013.

Recommendation # 8 re: FEP/WSF

Direct staff to initiate consultation with MIRROR NS and the Community Monitoring Committee on options for changes in the operating model (front end processor, waste stabilization facility, residual disposal facility) at Otter Lake landfill site A, returning to Council with a transition plan for landfill operations at the site based on diversion outcomes resulting from the changes outlined in this report.

G. Otter Lake Landfill

Successes

Based on operational records, environmental monitoring and complaint records, the Otter Lake landfill site has achieved municipal program expectations in terms of community and environmental impacts. A standard of 'no complaints logged' is the accepted and predominant outcome for the annual reports on record with the exception of two periods, 2001/02 and fall 2011. The site is situated adjacent to one of the highest growth areas within the municipality which speaks to its lack of community and environmental impact.

HRM owns the lands associated with the landfill located at Otter Lake. MIRROR NS Limited currently operates the landfill for HRM in accordance with a design/build/operate contract entered into between the two parties in 1997. The contract includes a defined Operating Term that expires upon the earlier of the site reaching designed capacity as a landfill, or 25 years after the Acceptance Date (January 1, 1999).

Section 24.2 of the Mirror Agreement reads as follows:

> *At the end of the Operating Term, if the Facilities have reached capacity as a landfill such that no further waste is permitted to be disposed of at the Facilities under permits that have been issued at that time and no additional permits can be obtained to permit further waste to be disposed of at the Site or HRM elects, at its option to permanently close the Facilities, then HRM shall deliver a notice to Mirror not later than sixty (60) days after the end of the Operating Term stating that it is HRM's intention to permanently close the Facilities ("Notice of Intention to Close").*

Section 24.2 only requires HRM to permanently close the Facilities at the end of the Operating Term (a) if it elects to do so, or (b) if the Facilities have reached capacity and no additional permits can be obtained to permit further waste to be disposed of at the Site.

In addition, HRM and the Halifax Waste/Resource Society entered into a monitoring agreement of the landfill dated February 16, 1999 (the "CMC Agreement"). The CMC Agreement imposes no obligations on HRM with respect to closure of the landfill. The term of the CMC Agreement is open ended:

10.01 This Agreement shall be effective as of the date of its execution and, subject to this Agreement, shall remain in effect for such time as the Facilities are operated at the Site.

The Regional Plan, approved in 2006, contemplates the extension of the Otter Lake site beyond 2024:

- SU-22 - HRM shall, through a public consultation process as defined by Council, consider all options for a new regional waste processing and disposal facility, including siting a new facility, extending the life of the existing facility, and exploring waste diversion initiatives.

Over the past 12 years, HRM purchased 800 hectares of additional lands surrounding the site in order to maintain its isolation and support future operational needs. The landfill's current site approval permit is based on the original plan for 9 cells. As required, HRM has requested permit amendments as new cells were added or facility changes were made. Upon issuance of the amended approval permit, the expiration date is updated to reflect a new 10-year period. HRM has requested and received over two dozen approval permit amendments. The current approval permit, based on Cell 6 having been added to the facilities in October 2012, expires in 2022.

Based on provincial legislation, contracts, agreements and the Regional Plan, Regional Council is the sole authority to extend operations at Otter Lake beyond 2024. Operations at the site can be extended in the following ways:

- reducing tonnage delivered to the landfill and thereby extending the life of the originally planned remaining four cells with an updated permit beyond 2024;
- increasing the design height of the cells, thereby increasing the capacity of the existing 6 cells and extending their operational life beyond 2024 and an updated permit;
- executing the bullet above and adding the final three cells, 7-9, with an updated permit, further extending site operations;
- making no changes and requesting a new site approval permit for an additional block of cells adjacent to the originally planned 9 cells.

Challenges

The following requirements would be needed to extend operations at Otter Lake:

- negotiate a new agreement with the current contractor or new contractor in terms of extending beyond the initial operating agreement period of 1999-2024;
- apply to NSE for amended permits as the cells are developed/expanded beyond Cell 9 and/or 2024.
- Some members of the local community advocate that there is an agreement in place which mandates closure of the site in 2024.

Opportunities

Regional Council can choose to remain at Otter Lake beyond the current initial operating term and 2024. Otter Lake landfill represents significant opportunities for HRM's ISWMS program. Stantec identified a number of them in their system review. These included:

- A2 – Request Modification of the Nova Scotia Landfill Liner Specification
- A3 – Extend Life of Otter Lake Landfill through Vertical Expansion
- B1 – Create a Centralized Waste Resource Campus

The following factors support extension of operations at Otter Lake beyond 2024:

- Siting a new landfill in order to close an existing no-impact landfill with significant capacity is not sound environmental stewardship;
- Wasting capacity at the existing site through flow control is not sound environmental stewardship;
- Shutting down and abandoning a strategic regional asset unnecessarily and imposing a $100 million dollar new site development expense on tax payers is not sound fiduciary responsibility.
- Initiating a landfill siting process and exposing the municipality to all of the issues related to that process is not recommended given that the current site is fully capable of meeting HRM landfill needs well beyond the initial design duration.

Landfill Liner Specifications

Regional Council's direction included maintaining or improving environmental protection. Current landfill cell specifications mandated by Nova Scotia Environment were assessed by Stantec to be more stringent in terms of waste industry standards for second generation landfills. Otter Lake landfill liner design and construction currently exceeds NSE landfill liner guideline specification standards. The landfill liner is over 12 feet thick with multiple layers, including multiple membranes for leak protection.

In terms of fiscal performance, the cells are, therefore, more costly than industry standards. This is further impacted by the additional materials utilized at Otter Lake which were added to the specifications. In addition, the NS Landfill cell specifications were developed in response to the waste streams of the mid-1990s. The current waste stream which ends up in a landfill is significantly different. These factors support a review and validation of the current specifications in terms of potentially imposing an unnecessary program cost burden on tax payers.

However, Regional Council mandated no reduction of environmental protection. Validating the cell liner specifications from an environmental protection perspective based on mixed waste garbage stream contents has not been accomplished. This analysis would need to be completed in conjunction with a validation process entered into with the NS Department of Environment.

Vertical Extension

The addition of added height on cells with no identifiable environmental impact increases the economic sustainability of the development of cells at Otter Lake. This change also introduces

over 20 years of projected annual capital budget savings as noted below in Table 11. The key point in this representation is that these are not discretionary potential budget avoidance savings. These capital dollars would have to be spent to fund future cells which are already in the long range forecast budget to support Cells 7-9. Vertical extension can significantly reduce the additional physical impact of additional cells on site lands by extending the use of existing cells through managed/engineered cell height increases.

Table 11

Cell Height Scenario's Projected Capital Budget Cost Avoidance		
Cell Height Increase	**Resulting Year The Next Cell Would Need to be Built**	**Projected Budget Savings / Cost Avoidance**
15m	2034 - 2036	$ 114M - $ 117M
10m	2029 - 2031	$ 74M - $ 82M
5m	2023 - 2024	$ 36M - $ 43M
Current	2016	$0

Based on current reserve funding and past budgets the immediate funding outcome of increasing cell height would be approximately $11.5M surplus for FY2013/14. There will be an additional $6.3M which will be allocated from the 14/15 budget to the reserve for cell 7 which can also be saved.The five-year budget cost avoidance savings of vertical extension is over $50 million. This represents cost avoidance and system savings which could fully fund all identified ISWMS program capital and program investment requirements. These include:

- Organics program changes and capital investment requirements;
- Future MRF replacement costs if the decision is to use tax pay funding
- Cart replacement projects
- Integrating apartments into the residential collection regime
- Developing landfill gas to energy project

Industry analysis assesses current cell height protocols impose higher than industry standard capital cost/tonne investment on HRM with no quantifiable environmental benefit. There are no identified environmental impacts resulting from increasing cell height. Visual testing proved no change to existing visual conditions. Based on current industry practices, and the effectiveness of remedial site restoration practices employed today, it is recommended that an increase in height across all existing and future cells be implemented at the Otter Lake site.

ISWMS Campus Model

The need to develop a new MRF site represents an opportunity to capitalize on the existing Otter Lake site and infrastructure. HRM already owns the land necessary to develop a new MRF at Otter Lake. Otter Lake has existing scales and administration facilities. Co-location at the site with the existing facilities represents future flexibility in terms of program options. Should HRM introduce an alternative technology option, such a facility is likely to also benefit from co-

location with the residual waste and recycling streams. Transportation of materials to processing sites increases program costs and reduces material revenue returns. This is the fiscal performance benefit of a campus model.

As alternative technologies evolve, waste stream materials management will likewise evolve. Materials will be separated for processing in alternative technologies. These may include materials in both the residual garbage stream and products with low recycling market value which are beneficial to alternative technology systems as a fuel source or for chemical recycling. Long-term planning should continually adapt to be cost effective and/or evolve waste stream materials management, processing and usage. As a result of its mature multi-stream waste resources management program, HRM is well-positioned to capitalize on future alternative technologies as they become operational realities. A campus model represents a strategic decision to incorporate a cost effective, efficient and adaptable system model to support future opportunities.

A future campus site also supports economic opportunities related to regionalization of the ISWMS through partnerships with adjacent municipalities. Based on HRM's size of operations, organics and recycling processing is more economical. Accepting materials for processing from other jurisdictions at reduced costs due to economies of scale offers the reciprocal opportunity to send waste materials at reduced rates to other regional landfills. The double use of a transport-trailer reduces overall system costs and improves fiscal performance. A campus represents the optimized central location of material processing for loading and off-loading transfer trailers.

The Otter Lake landfill also introduces the opportunity to explore utilizing landfill gas as a power source. As with the closed Sackville landfill, HRM could develop a landfill gas energy project which would produce electricity. A campus model would then include its own electricity and heat source for power needs. A new MRF located at the campus will require electricity to run the processing systems and require heat to support the large open facility. A generic power and heat source at a campus would further reduce program operating costs.

A landfill gas to energy project for Otter Lake still requires a full business case analysis. However, HRM's existing landfill gas-to-energy project partner, who operates the landfill gas project at the closed Sackville Landfill site, completed preliminary analysis in terms of gas generation and project costs and assessed a project would be viable. Stantec also advanced this position. Given the capital investment for a landfill gas project, this opportunity depends on the decision to extend operations Otter Lake beyond the current 9 cell plan and 2024.

Future alternative technology projects co-located at the campus site could also support the provision of power to facilities located at Otter Lake. All operations located at the Otter Lake site would benefit from locally generated HRM owned power and heat.

Co-location of new infrastructure which could utilize on-site generated power and heat through energy from waste projects provides a significant program incentive. Utilizing existing and/or the addition of new infrastructure facilities and systems to support campus site represents a less costly option than developing new dissipated sites.

The development of Otter Lake as an ISWMS campus site addresses both environmental stewardship and system fiscal performance based on:

- Co-location of other ISWMS components, such as a future new recycling facility, would be more cost efficient in terms of sharing existing operational infrastructure.
- HRM already owns sufficient property at Otter Lake to support any future ISWMS facility component need.
- Analysis is on-going to establish a project to capture landfill gases for use in an Energy from Waste (EFW) plant which could generate sufficient electricity to support all site power and heat requirements.
- Potential repurposing of existing facilities to other ISWMS component requirements would further reduce future capital cost investment requirements.
- Evolution of the ISWMS in terms of utilizing other regional waste industry asset capacity and utilizing Otter Lake facilities as a transfer station eliminates the requirement to develop a new transfer station. The FEP is a transfer station in terms of functionality.
- A campus will reduce identified future system requirement investment and operating costs.

Repurpose the FEP & WSF structures

The WSF is an aerobic composting facility which could provide up to an additional 30,000 tonnes of SSO aerobic processing capacity annually. A new plant of equal capacity would cost well over $10 million. In 2010, HRM refurbished the roof of the WSF which should now last an extended operational life well beyond 2024. Should conditions change at the site to permit the repurposing of the WSF to process organics rather than garbage mixed with putrescible organics, this could support reducing system strain on organics processing.

The FEP is essentially a transfer station which could be re-purposed to provide transfer station capacity within HRM. Should conditions change at the site which permits the repurposing of the FEP into a transfer station, this could save HRM upwards of $10 million dollars in infrastructure costs. In a campus scenario, the FEP could be used to load organics or garbage for backhauling to other regions who contract HRM for processing their recycling. HRM could also take advantage of backhauling waste from Otter Lake campus to utilize other landfill capacity at lower costs including ICI sector waste transfer operations with flow control removed. These initiatives could further reduce system costs with offsetting revenues. In addition, both the FEP and WSF could provide more adaptability as the ISWMS evolves, especially when operationally viable alternative technologies are eventually introduced.

Consultation Feedback

During the consultation phase of the strategy review, a position raised by CMC, members of the local communities who participated and employees of MIRROR NS was to *Honour the Contract and Agreement* to close the Otter Lake site in 2024. CMC objected to the option of extending operations at the Otter Lake site. CMC's position, acting on behalf of local residents, is that the contract and agreement with the community requires HRM to close the site in 2024. The "contract" in question is with the site operator, MIRROR NS and the "agreement" is with CMC

which forms a part of the contract with MIRROR NS but signed separately 16 February, 1999.

The same consultation feedback from the FEP/WSF section applies to this section.

As a result of the direct implication of extending operations at Otter Lake beyond 2024, there was strong opposition voiced by event participants to the establishment of an ISWMS campus at Otter Lake.

During the industry session, the following concerns were raised:

- Congestion in terms of traffic to deliver loads to various facilities through one gate/entrance and scale operation;
- In the event of an environmental or public safety emergency, the site could be closed for access to all facilities;
- Labour issues and unrest might restrict facility access impacting all operations.

Recommendation # 9 re: Otter Lake

Extend operations at Otter Lake beyond 2024, and direct staff to increase the vertical height of existing and future cells by 15 meters and establish an ISWMS campus to support new facilities and alternative technologies as they become viable.

LEGAL IMPLICATIONS

HRM Legal services division has reviewed this report and provided legal opinions under separate cover as required. Regional Council has legal authority under the *Halifax Regional Municipality Charter* to make By-laws implementing the recommendations contained herein.

FINANCIAL IMPLICATIONS

In order to provide some degree of financial assessment of the above outlined options, initiatives and recommendations, staff developed a two scenario comparison model. Scenario 2 is further sub-divided into (a , b & c), (a) having the FEP/WSF remain operating, (b) having the FEP/WSF phased out in 2016/17 and (c) with the FEP/WSF facilities no longer pre-processing waste for disposal in 2014/15.

Financial Scenario Options Analysis:

Table 12 below outlines the ten year overview of the options in terms of overall system costs.The Estimated Solid Waste Program Cost sheet illustrates the estimated solid waste costs for the status quo as well as three scenarios outlined below going out to 2024/25. The individual scenario tables outline just the program changes taking place for each scenario and how these additional program changes would be paid for or create a budget pressure to be covered in the case of the status quo scenario.

Table 12

Estimated Solid Waste Program Cost 2014/15 - 2024/25				
	Operating	**Capital**	**New Capital**	**Total Cost to 2024/25**
Scenario 1 - Status Quo	$480,000,000	$126,000,000	$144,000,000	$750,000,000
Scenario 2A - FEP/WSF Remain	$453,000,000	$60,000,000	$44,000,000	$557,000,000
Scenario 2B - FEP/WSF Phased out after 2016/17	$379,000,000	$46,000,000	$44,000,000	$469,000,000
Scenario 2C - FEP/WSF Removed	$355,000,000	$42,000,000	$44,000,000	$441,000,000

Note: New infrastructure costs have been identified in terms of potential future system costs. Infrastructure development requirements can be met through public or private RFP funding of capital projects. Full business case analysis will determine the appropriate mechanism to meet the infrastructure requirements.

In Scenario 1 there are no changes to operations at the Otter Lake Facilities, FEP and WSF continue operations and landfill cell heights remain the same. Composting operations are adjusted to include upgrades in Burnside which facilitate pre-processing of ICI organics for off-site Anaerobic Digestion. Upgrades to ensure regulatory compliance and to meet capacity needs also occur to the existing aerobic composting operations. A secondary compost curing site is programmed for 2015 and a new Recycling Facility is planned for 2016. Procurement of recycling carts and replacement organics carts is programmed for 2017 to enable roll out in 2018/19 prior to operations at a new MRF.

Table 13

SCENARIO 1 STATUS QUO 2014/15 - 2024/25	
Adjustments to Compost Program	(-$24,000,000)
New Recycling Facility	$10,000,000
Secondary Compost Curing Site	$4,000,000
Increase Organics Capacity	$5,000,000
Multiple Stream Collection Carts (Blue/Green)	$25,000,000
New Landfill Site	$100,000,000
Total	$144,000,000
Net Cost Position	**$120,000,000**

Scenario 2A – FEP/WSF Included

In Scenario 2A, the FEP and WSF continue operations and landfill cell heights increase by 15 metres. Control of waste export is removed and Commercial garbage tip fees are increased to $170 per tonne. The household hazardous waste program is expanded. Composting operations are adjusted to include upgrades in Burnside which facilitate pre-processing of ICI organics for off-site Anaerobic Digestion. Upgrades to ensure regulatory compliance and to meet capacity needs also occur to the existing aerobic composting operations. A secondary compost curing site is programmed for 2015 and a new Recycling Facility is planned for 2016. Procurement of recycling carts and replacement organics carts is programmed for 2017 to enable roll out in 2018/19 prior to operations at a new MRF.

Table 14

SCENARIO 2A with FEP/WSF 2014/15 - 2024/25

Increase - Tip Fee Charge ($170/t)	(-$25,000,000)
Savings from No Flow Control	(-$21,000,000)
Savings from Stacking	(-$56,000,000)
Adjustments to Compost Program	(-$24,000,000)
Total	(-$101,000,000)
Increase - HHW Depots	$8,000,000
New Recycling Facility	$10,000,000
Secondary Compost Curing Site	$4,000,000
Increase Organics Capacity	$5,000,000
Multiple Stream Collection Carts (Blue/Green)	$25,000,000
Total	$52,000,000
Net Cost Position	**(-$49,000,000)**

Scenario 2B – FEP/WSF phased out in 2016/17

In Scenario 2B, the FEP and WSF are no longer operated after 2016/17 and landfill cell heights increase by 15 metres. Control of waste export is removed and Commercial garbage tip fees are increased to $170 per tonne. The household hazardous waste program is expanded. Composting operations are adjusted to include upgrades in Burnside which facilitate pre-processing of ICI organics for off-site Anaerobic Digestion. Upgrades to ensure regulatory compliance and to meet capacity needs also occur to the existing aerobic composting operations. A secondary compost curing site is programmed for 2015 and a new Recycling Facility is planned for 2016. Procurement of recycling carts and replacement organics carts is programmed for 2017 to enable roll out in 2018/19 prior to operations at a new MRF.

Table 15

SCENARIO 2B - FEP/WSF Phased out after 2016/17	
Increase - Tip Fee Charge ($170/t)	(-$25,000,000)
Savings from No Flow Control	(-$21,000,000)
Savings from Stacking	(-$56,000,000)
Adjustments to Compost Program	(-$24,000,000)
Remove FEP/WSF	(-$86,000,000)
Total	(-$187,000,000)
Increase - HHW Depots	$8,000,000
New Recycling Facility	$10,000,000
Secondary Compost Curing Site	$4,000,000
Increase Organics Capacity	$5,000,000
Multiple Stream Collection Carts (Blue/Green)	$25,000,000
Total	$52,000,000
Net Cost Position	**(-$135,000,000)**

Scenario 2C – FEP/WSF Removed

In Scenario 2C, the FEP and WSF are no longer operated and landfill cell heights increase by 15 metres. Control of waste export is removed and Commercial garbage tip fees are increased to $170 per tonne. The household hazardous waste program is expanded. Composting operations are adjusted to include upgrades in Burnside which facilitate pre-processing of ICI organics for off-site Anaerobic Digestion. Upgrades to ensure regulatory compliance and to meet capacity needs also occur to the existing aerobic composting operations. A secondary compost curing site is programmed for 2015 and a new Recycling Facility is planned for 2016. Procurement of recycling carts and replacement organics carts is programmed for 2017 to enable roll out in 2018/19 prior to operations at a new MRF.

Table 16

SCENARIO 2C FEP/WSF REMOVED 2014/15 - 2024/25	
Increase - Tip Fee Charge ($170/t)	(-$25,000,000)
Savings from No Flow Control	(-$21,000,000)
Savings from Stacking	(-$56,000,000)
Adjustments to Compost Program	(-$24,000,000)
Remove FEP/WSF	(-$114,000,000)
Total	(-$215,000,000)
Increase - HHW Depots	$8,000,000
New Recycling Facility	$10,000,000
Secondary Compost Curing Site	$4,000,000
Increase Organics Capacity	$5,000,000
Multiple Stream Collection Carts (Blue/Green)	$25,000,000
Total	$52,000,000
Net Cost Position	**(-$163,000,000)**

COMMUNITY ENGAGEMENT

The community engagement (CE) program evolved through discussions and motions of the Environment and Sustainability Standing Committee and Regional Council. Given the scope and duration of the CE program, HRM retained NATIONAL Public Relations to design and conduct it according to HRM's Community Engagement Strategy, and to collect all feedback into a comprehensive CE report, which NATIONAL delivered to HRM on December 6, 2013 (Attachment C).

Throughout the CE process, NATIONAL aligned all program components with the engagement plan outlined in the staff report to the Environment and Sustainability Standing Committee dated February 26, 2013, and the motions approved by Regional Council on April 23, 2013. This approach helped ensure that as many perspectives as possible from the landfill host community participants, other HRM residents, businesses, and waste industry stakeholders would be considered in Regional Council's eventual decisions for the entire solid waste system in HRM.

NATIONAL and HRM staff hosted 14 engagement events during September and October 2013 and maintained continuous online engagement throughout the same period using the ShapeYourCityHalifax.ca website. NATIONAL estimates about 700 people participated in the in-person events during Phase I of the CE program and approximately 600 attended during Phase II, with the majority of participants self-identifying as living in the districts (11, 12 and 13) closest to the Otter Lake landfill. For the online engagement component, participants completed 454 surveys, 291 quick polls and posted 95 comments in the discussion forums.

During the in-person and online engagement activities, NATIONAL used many diverse opportunities for participants to have their say on various questions and concerns regarding the

many implications of the system-wide review of solid waste management in HRM. NATIONAL also conducted public opinion research through two surveys during the CE process. All of these activities and approaches are detailed in the final CE report (Attachment C).

Early in the engagement planning process, representatives from NATIONAL met with the Community Monitoring Committee (CMC) to discuss the overall engagement approach and how CMC could best represent the communities closest to the existing landfill site. CMC provided the engagement team written recommendations for community engagement that helped inform the event design, location and timing of the town hall meetings and regional public sessions.

At all public events, CMC was provided an opportunity to speak and present information on the history of the solid waste resource management strategy, siting of the landfill and the agreement with the host community.

Despite widespread promotion and significant media coverage during the CE program, NATIONAL was consistently challenged to raise general public interest in the matters related to the solid waste strategy review and increase broad public participation at the engagement events. Of those who attended regional public events (approximately 200 during Phase I and 175 during Phase II), most identified themselves as having a direct interest in the Otter Lake Landfill through either residential proximity or employment. A number of others indicated they had historically been involved the development of the 1996 Solid Waste Resource Management Strategy.

Generally, many of these participants were very vocal about their position on the options under consideration within the strategy review, especially any options related to proposed changes at the Otter Lake landfill site. As a result, NATIONAL adapted the CE program design in advance of Phase II to help capture public feedback about the entire waste management system and the diverse recommendations in the Stantec report as mandated by Regional Council.

The verbatim comments and quantitative survey results from the entire CE program are included in NATIONAL's final CE report (Attachment C). Key findings from the NATIONAL report are included in the Consultation Feedback comments for each of the solid waste system components examined in the Discussion section above.

ENVIRONMENTAL IMPLICATIONS

The above noted recommendations support and advance the following environmental goals:

- Aligned with all Regional Council's Environmental priorities
- Reduces HRM's GHG emissions and footprint
- Development of landfill gas to energy project will produce a renewable power source and reduce HRM's power costs

ALTERNATIVES

Organics

- Maintain status quo; make no changes to existing program or infrastructure. This will not meet capacity requirements or regulatory requirements. Not recommended.
- Do not make amendments to By-law S-600 in terms of revised organics collection measures, mandated kraft paper bags for separate leaf and yard waste collection, banning grass clippings for collection. Not recommended.

Residual Waste / Garbage

- Maintain status quo, do not mandate clear bags or a bag limit reduction. Not recommended.
- Incorporate private investment property complexes into the residential collection region. Not supported unless other program savings and cost avoidance measures fund the additional $5million program cost.
- Do not amend By-law S-600 to repeal flow control of residual waste/garbage generated within HRM. Not recommended.
- Increase tip fees without repealing flow control which will transfer this new higher service cost to businesses. Not recommended.
- Do not increase landfill tip fee. HRM would continue to subsidize ICI sector for waste processing and landfill costs. Not recommended. If flow control were removed, the increased tip fee will act as the incentive for waste materials to be delivered to other sites, saving Otter Lake capacity and improving system fiscal performance. Finally, increasing tip fee will continue to encourage increased effort to divert organics and recyclables from the waste stream.

Household Special Handling Waste

- Maintain the status quo, do not increase to a second depot or increase mobile events. Not recommended.
- Maintain one depot but increase to 16 district mobiles per year. This option will cost less than the equivalent of a second permanent deport.

FEP/WSF

- Maintain the status quo; do not modify the operating model to reflect tonnage reductions and waste stream changes at Otter Lake. Not recommended

Otter Lake

- Maintain status quo, do nothing. Requires the immediate approval to commence siting a new landfill. This will require budgeting $100 million dollars to pay for the development of the new site. This cost would be spread across the next ten years, adding $10 Million

capital yearly. Not recommended.

- Continue to use Otter Lake until it reaches capacity and then enter into agreements with neighboring landfill sites to receive HRM waste. Not recommended.
- Continue to use Otter Lake until it reaches capacity and explore alternative technology options and if a viable option presents a practical alternative, negotiate an agreement for receipt of HRM residual wastes. Not recommended.

ATTACHMENTS

Attachment A – Stantec Waste Resource Strategy Update Report – January 2013
Attachment B – SNC Lavalin Peer Review of the January 2013 Stantec Report 'Waste Resource Strategy Update' – April 2013
Attachment C – NATIONAL Public Relations Final Report – December 2013
Attachment D – IPOANS Letter
Attachment E – Canadian Restaurant and Food Services Association (CRFSA)
Attachment F – Waste Management Letter
Attachment G – Miller Waste Systems Letter
Attachment H – Other City Comparative Matrix
Attachment I – Financials Table
Attachment J – 5July96 SWRAC Report
Attachment K – HRM Briefing Session – Fundamental Beliefs of HRM

Appendices

Appendix 1 – Flow Control
Appendix 2 – Cost of Integrating Investment Properties into Residential Collection Regime
Appendix 3 – Clear Bag Program Data
Appendix 4 - ICI Mass Balance Breakdown
Appendix 5 – Evolution of Costs of Residual Garbage
Appendix 6 – System Performance Report Card and Diversion Pie Charts
Appendix 7 – Functional Analysis of the FEP/WSF
Appendix 8 - Cell Increase in Height Implications

A copy of this report can be obtained online at http://www.halifax.ca/council/agendasc/cagenda.html then choose the appropriate meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: Gord Helm, Manager, Solid Waste Resources, 490-6606

Original Signed by Director

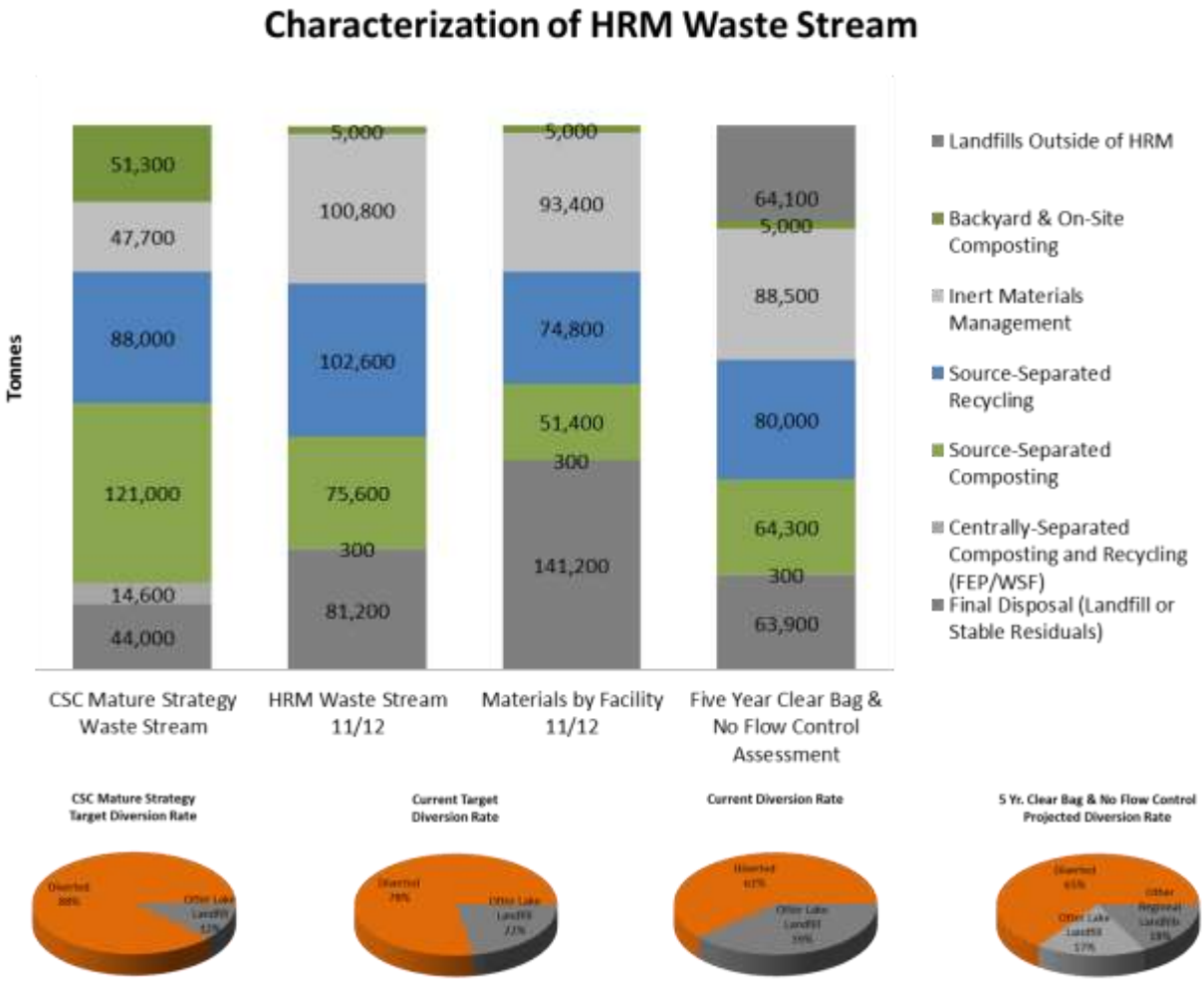
Financial Approval by: _____
Greg Keefe, Director of Finance & ICT/CFO, 490-6308

Appendix 1 – Flow Control

In 2002, HRM implemented By-law amendment S-602, banning the export of waste generated within HRM. This measure was made to secure revenues generated from user pay tip fees from the ICI sector. The intent was to protect user fees to support mandated municipal waste management programs and infrastructure.

The following figure compares the amount (tonnes) of the various HRM waste/resource streams within the CSC Strategy; HRM staff's characterization of 2011/2012 available tonnage; 2011/2012 diverted tonnage and a 5 year projection of the effect of removing flow control and requiring clear bags for garbage. All four columns are based on the 2011/2012 total available tonnage of 366,100 tonnes.

Figure 7



The CSC's original system estimate of HRM's waste stream identified 172,300 tonnes of organics, plus what would have been diverted through the FEP/WSF. Waste characterization studies estimate that number to be closer to 81,000 tonnes. Those characterization studies also estimate there is more inert and recyclable material available to divert than the original Strategy estimates. The third column from the left shows the breakdown of waste materials in terms of delivery to HRM facilities. This provides a realistic comparison to the original estimates of stream makeup of the first column. The final column provides an estimate of the effect of eliminating flow control for ICI residual waste (garbage) and By-law changes reducing bag limits and requiring garbage be placed in clear bags. As shown, HRM diversion improves from 61% to 65%.

HRM's current cost per tonne for landfill operations is $170.00 based on construction and operations at of Cell 6. This is based on smoothed future costs of developing Cells 7, 8 & 9 over the next 10 years. This cost/tonne assumes an average of 140,000 tonnes per year of waste materials being delivered to Otter Lake. Based on program pressures and fiscal requirements to sustain program costs, HRM tip fees should be raised to $170.00/tonne to reflect actual landfill costs. This cost will impact the HRM business community as a flow through service cost increase from haulers to businesses.

Eliminating flow control will reduce waste delivered to Otter Lake landfill which will extend the life of cells. For example, if flow control were eliminated and if 60% of ICI waste being delivered to other landfill sites in the region, HRM would benefit from a two year delay in developing cell 7. See the figures below which show the delay in construction and fill dates for future cells based on scaled percentage reduction in tonnage delivered to HRM's landfill.

Figure 8

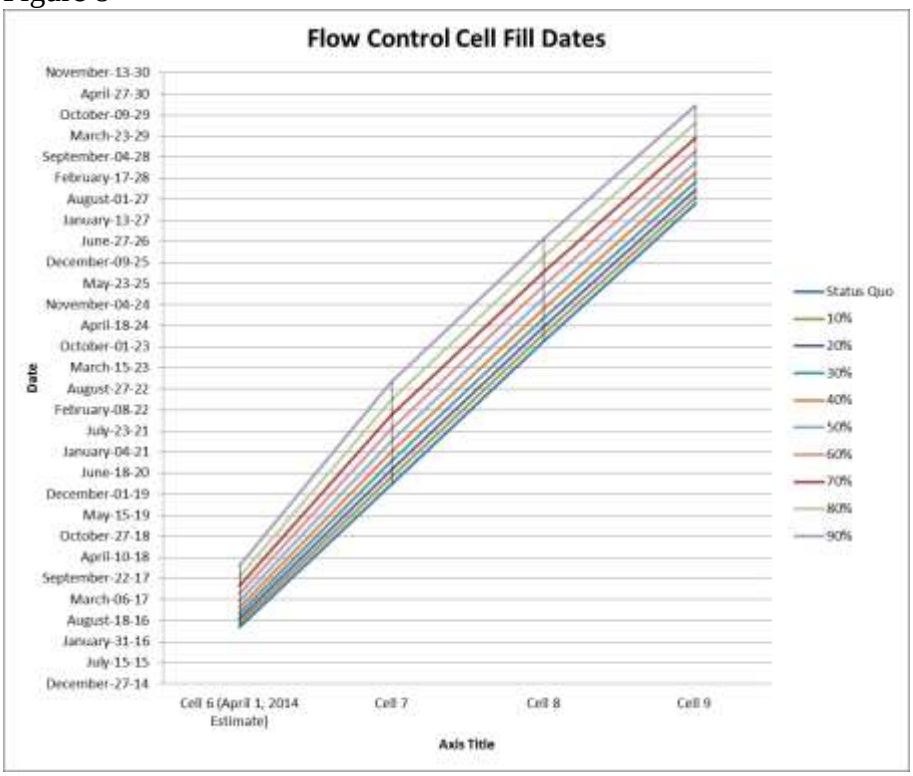
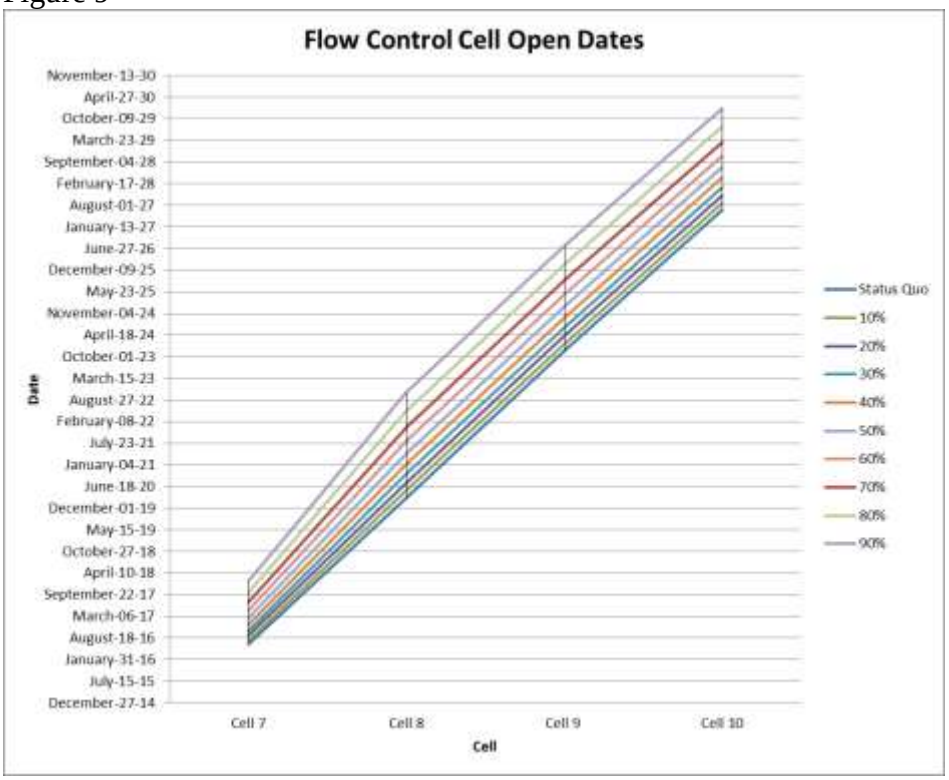


Figure 9



This reduction in delivered waste enables amortization of future cells over a longer period of time reducing capital budget pressures. To be clear, this is not reducing system costs, cells still cost the same, but their operational life is extended through reduced tonnage being delivered annually. This aligns with the CSC Strategy vision of reducing system costs through diversion from landfill.

Flow Control Opportunity Analysis

The following three tables illustrate cost analysis showing reduced revenues due to lost tip fees. However, the tables show the offsetting system costs balance in terms of cost avoidance from delaying cell construction and the corresponding extended amortization of capital costs. The subsequent three tables show current status quo costs with cell 6 constructed (Table 16), reduced tonnage due to flow control elimination and corresponding cell life extension (Table 17), and a similar assessment as table two but using construction of cell 7, currently scheduled for the 2015/16 capital construction season (Table 18).

Table 16

STATUS QUO				
Tonnage Band	**134,240 and 137,239**	**131,240 and 134,239**	**128,240 and 131,239**	
Cost Per Tonne Review Cell 6				
	13/14	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 102	$ 106	$ 109	$ 106
Capital Cost Per Tonne - Cell	$ 48	$ 48	$ 48	$ 48
Capital Cost Per Tonne - Equipment	$ 12	$ 12	$ 12	$ 12
Perpetutal Care	$ 2	$ 2	$ 2	$ 2
Total Cost per Tonne	$ 164	$ 168	$ 171	$ 168
Variable Costs Cell 6				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 59	$ 60	$ 62	$ 60
Capital Cost Per Tonne - Cell	$ 48	$ 48	$ 48	$ 48
Capital Cost Per Tonne - Equipment	$ 12	$ 12	$ 12	$ 12
Perpetutal Care				
Total Variable Cost per Tonne	$ 119	$ 120	$ 122	$ 120
Fixed Costs cell 6				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 43	$ 45	$ 47	$ 45
Capital Cost Per Tonne - Cell				
Capital Cost Per Tonne - Equipment				
Perpetutal Care	$ 2	$ 2	$ 2	$ 2
Total Fixed Cost per Tonne	$ 45	$ 47	$ 49	$ 47

Table 17

With Flow Control Removed

Tonnage Band	134,240 and 137,239	125,000	125,000	
Cost Per Tonne Review Cell 6				
	13/14	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 102	$ 110	$ 112	$ 108
Capital Cost Per Tonne - Cell	$ 48	$ 48	$ 48	$ 48
Capital Cost Per Tonne - Equipment	$ 12	$ 12	$ 12	$ 12
Perpetutal Care	$ 2	$ 2	$ 2	$ 2
Total Cost per Tonne	$ 164	$ 172	$ 174	$ 170
Variable Costs Cell 6				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 59	$ 60	$ 62	$ 60
Capital Cost Per Tonne - Cell	$ 48	$ 48	$ 48	$ 48
Capital Cost Per Tonne - Equipment	$ 12	$ 12	$ 12	$ 12
Perpetutal Care				
Total Variable Cost per Tonne	$ 119	$ 120	$ 122	$ 120
Fixed Costs cell 6				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 43	$ 50	$ 51	$ 48
Capital Cost Per Tonne - Cell				
Capital Cost Per Tonne - Equipment				
Perpetutal Care	$ 2	$ 2	$ 2	$ 2
Total Fixed Cost per Tonne	$ 45	$ 52	$ 53	$ 50

Table 18

With Flow Control Removed (Opportunity Cost Cell 7)

Tonnage Band	134,240 and 137,239	125,000	125,000	
Cost Per Tonne				
	13/14	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 102.24	$ 109.98	$ 112.42	$ 108.21
Capital Cost Per Tonne - Cell 7	$ 52.57	$ 52.57	$ 52.57	$ 52.57
Capital Cost Per Tonne - Equipment	$ 11.70	$ 11.70	$ 11.70	$ 11.70
Perpetutal Care	$ 1.97	$ 1.97	$ 1.97	$ 1.97
Total Cost per Tonne	$ 168.48	$ 176.22	$ 178.67	$ 174.46
Variable Costs				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 58.85	$ 60.32	$ 61.83	$ 60.34
Capital Cost Per Tonne - Cell 7	$ 52.57	$ 52.57	$ 52.57	$ 52.57
Capital Cost Per Tonne - Equipment	$ 11.70	$ 11.70	$ 11.70	$ 11.70
Perpetutal Care				
Total Variable Cost per Tonne	$ 123.12	$ 124.59	$ 126.10	$ 124.60
Fixed Costs				
Per Tonne Savings Cost	**13/14**	**14/15**	**15/16**	**Average**
Operating Cost Per Tonne	$ 43.39	$ 49.66	$ 50.59	$ 47.88
Capital Cost Per Tonne - Cell 7				
Capital Cost Per Tonne - Equipment				
Perpetutal Care	$ 1.97	$ 1.97	$ 1.97	$ 1.97
Total Fixed Cost per Tonne	$ 45.36	$ 51.63	$ 52.57	$ 49.85

The above three tables (16, 17 & 18) outline the breakdown and essentially balanced cost outcome of eliminating garbage flow control to HRM program costs. This analysis is based on a

15,000 tonne reduction in tonnage delivered to Otter Lake as a result of exported waste materials. This would bring delivered tonnage at Otter Lake to 125,000.

If tonnage drops below 125,000 tonnes it triggers a re-negotiation of the current Otter Lake price agreement. Lower operating costs should result from significantly reduced tonnages received at Otter Lake. Therefore, although the initial assessment of removing flow control of ICI garbage would be a balanced outcome of off-setting costs, the final system cost outcome should reflect a positive reduction in system costs to HRM.

Table 19 defines the formula for tonnage band rebate based on reducing tonnage delivered to Otter Lake. This is only calculated to the base tonnage of 125,240 tonnes / year.

Table 19

Baseline Tonnage	149,240 tonnes	Tonnage rebates are based on the negotiated tonnage baseline. Period: 2010-2016 Band Size: 3,000 tonne/year increments Rebate Rate: $41.93 per tonne plus margin Annual Inflation adjustment: 2.5%. 26

27

The following figure outlines the tonnage band rebates included in the current price agreement with MIRROR NS. As is depicted, as tonnage decreases, the annual operating cost rebate increases. Based on this position, when tonnage decreases below the current baseline of 125,240 tonnes/year, the operating cost rebate will be greater than the current maximum rebate.

Figure 10

If annual tonnage received at the Facilities is between:						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
125,240 and 128,239	-$902,543.25	-$925,106.83	-$948,234.50	-$971,940.36	-$996,238.87	-$1,021,144.85
128,240 and 131,239	-$773,608.50	-$792,948.71	-$812,772.43	-$833,091.74	-$853,919.03	-$875,267.01
131,240 and 134,239	-$644,673.75	-$660,790.59	-$677,310.36	-$694,243.12	-$711,599.20	-$729,389.18
134,240 and 137,239	-$515,739.00	-$528,632.48	-$541,848.29	-$555,394.49	-$569,279.36	-$583,511.34
137,240 and 140,239	-$386,804.25	-$396,474.36	-$406,386.22	-$416,545.87	-$426,959.52	-$437,633.51
140,240 and 143,239	-$257,869.50	-$264,316.24	-$270,924.14	-$277,697.25	-$284,639.68	-$291,755.67
143,240 and 146,239	-$128,934.75	-$132,158.12	-$135,462.07	-$138,848.62	-$142,319.84	-$145,877.84
146,240 and 152,240	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
152,241 and 155,240	$128,934.75	$132,158.12	$135,462.07	$138,848.62	$142,319.84	$145,877.84
155,241 and 158,240	$257,869.50	$264,316.24	$270,924.14	$277,697.25	$284,639.68	$291,755.67
158,241 and 161,240	$386,804.25	$396,474.36	$406,386.22	$416,545.87	$426,959.52	$437,633.51
161,241 and 164,240	$515,739.00	$528,632.48	$541,848.29	$555,394.49	$569,279.36	$583,511.34
164,241 and 167,240	$644,673.75	$660,790.59	$677,310.36	$694,243.12	$711,599.20	$729,389.18
167,241 and 170,240	$773,608.50	$792,948.71	$812,772.43	$833,091.74	$853,919.03	$875,267.01
170,241 and 173,240	$902,543.25	$925,106.83	$948,234.50	$971,940.36	$996,238.87	$1,021,144.85

Note: Variation Amount equals "Service Fee Adjustment" for the operating year of the Agreement Term per the above schedule plus 20% margin.

[26] Regional Council Report, MIRROR NS – 2010–2016 Operations & Price Agreement, 8 September 20, 2011, page 5.

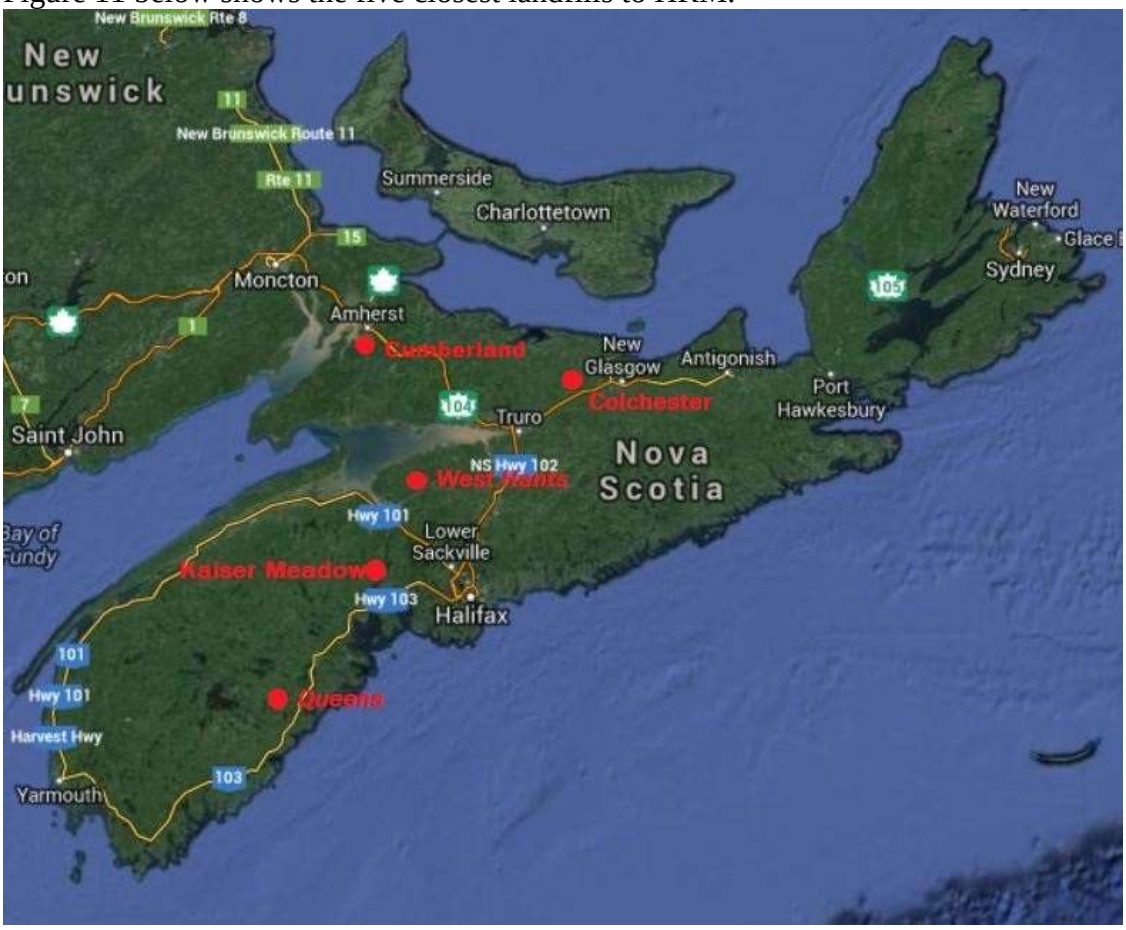
Elimination of flow control on ICI garbage affects waste service costs across the entire ICI and business community. Reduced service costs for HRM businesses are a positive economic outcome. This also supports free market competition for haulers delivering waste to landfills outside HRM at lower tip fee rates.

The table below shows tip fees promulgated for the four closest landfills within practical transportation distances from HRM. Of note, tip fees are in fact negotiable depending on the quantity of materials a hauler intends to deliver. Therefore, promulgated tip fees would reflect a cost higher than a lower negotiated cost based on planned deliveries.

Table 20

Name of Landfill	Distance fm HRM	Time to Travel	Tip Fee (Promulgated)	X $4.85/km/20 tonnes	Total Cost/Tonne
Chester	**72 km**	**47 min**	**$79.36**	**$17.46**	**$96.82**
West Hants	**86 km**	**63 min**	**$65.00**	**$20.86**	**$85.86**
Cumberland	**137 km**	**92 min**	**$165.00**	**$45.48**	**$210.48**
Queens	**151 km**	**96 min**	**$79.17**	**$36.62**	**115.78**

Figure 11 below shows the five closest landfills to HRM.



*****Currently Colchester does not accept garbage from outside in the agreement they have with their host community. They will accept C&D, recyclables and other specials waste.

Adjacent regional landfills have confirmed that they would be more than willing to accept ICI waste generated within HRM.

Fundamental Principles of HRM Program (Attachment K)

In the May 28, 2002, report to Regional Council recommending the restriction of the export of solid waste material generated within HRM, there is the following statement: "a policy statement that was included in the early development of the Integrated Solid Waste Resource Management Strategy – "Stewardship – We Manage the Materials We Generate."

This position is based on an HRM Council Memorandum dated 14 February, 1996, Proposed Work Plan for Halifax Regional Municipality Solid Waste/Resource Management Strategy, Attachment K, Fundamental Beliefs of HRM related to the approval in principle of the CSC Strategy, which outlines:

Regarding Community Principles:

1. That we {HRM} intend to deal with all aspects of the solid waste/resource stream within our jurisdiction through the Strategy; and that,
2. Communities' issues such as competitiveness for existing businesses and facilities; and,
3. Employment security for existing system employees; and,
4. Traffic issues, tipping fee policy and a regulatory environment consistent with protecting the taxpayer base from adverse implications are essential; and,
5. That the system represents a cost efficient approach to this high standard of environmental protection.

The management of materials within HRM boundaries was not intended to adversely affect taxpayers and the business community in terms of higher system costs and service costs. This system outcome is contrary to the intent of the outlined "Community Principles".

The principle of "dealing with all aspects of the solid waste/resource stream within our jurisdiction through the Strategy" enables the judicious reservation of landfill capacity and the corresponding protection of the physical environment from reducing cell use. All landfills within NS are governed by the same legislative environmental safety standards as is HRM's landfill. Therefore, since the material would only be delivered to NSE approved and permitted landfills, there would be no reduction of environmental protection from using a landfill outside HRM.

Appendix 2 – Cost of Integrating Private Investment Property Complexes into the Residential Collection Regime

Compliance with By-law S-600 program guidelines is complicated in private investment property complexes as a result of:

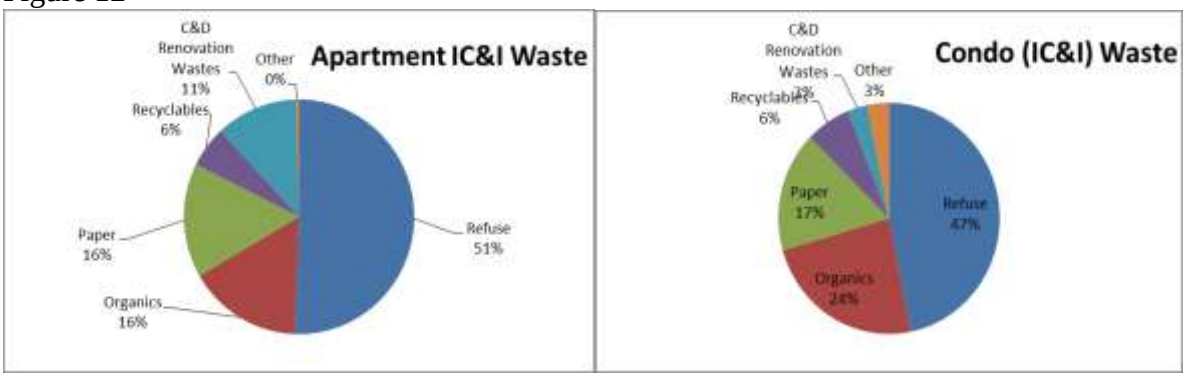
- Environmental Living Factors
    - Multiple floors to transport waste (easier to take 1 bag rather than multiple bags and a bin that has to be taken back up and cleaned)
    - Heavy doors (have heard this from seniors primarily)
    - Locked doors (bins often in parking garage and if you don't have a car, you don't have a key)
    - Presence of waste chutes on every floor
    - Security measures to control illegal dumping on their properties
    - Lack of education from manager/landlord/SWR that separation is required and how to do it
    - Lack of storage space in the apartments for the material streams (garbage, organics, blue bag, paper, cardboard)
    - Inconsistent or lack of signage in the building directing tenants to the source-separation areas/bins
    - Lack of practical means of holding non-participants accountable

- Demographic Factors
    - Tenants (cost, work schedules, inconvenience etc.)
    - Cultural and language barriers facing new Nova Scotians
    - Seniors (didn't grow up with program, find it confusing, scared of waste room and use chutes exclusively)
    - Single older working class men (don't care – had someone else do it for them at one time)
    - Single moms/young children (perceived increased cost with purchase of many coloured bags)

- Students (apathy, perceived cost, not understanding how)
- International students/families (apathy/disinterest/awareness/understanding)

Figure 12 depict pie graphs illustrating apartment verses condo waste stream makeup. There are different demographic groups in condos verses apartments. However, in terms of waste generation, the expectation is that they would be similar.

Figure 12



The garbage, organics and recyclables breakdown for condominium units serviced under HRM's contract is as follows:

Tonnes per HRM Serviced Condo Unit

Table 21

Fiscal	Garbage	Organics	Recyclables
12/13	0.293	0.40	0.089
11/12	0.26	0.04	0.08
10/11	0.27	0.05	0.08
09/10	0.3	0.05	0.1

- The per serviced unit cost for collection of garbage, organics and recyclables as specified in Tender No. 13-055 in the three collection areas is approximately $53.52 per serviced unit per year.
- New Program Cost – Assuming a similar per serviced unit cost as the Condos at $53.52 per serviced unit per year {there would also be additional HRM contract administrative costs} for the estimated 50,942 apartment units (HRM Finance 2013 estimate) **$53.52 x 50,942 = $2,726,416**
- There would be the loss of tip fees from these apartment units. The generation rates per unit could be considered to be similar to Condo units so:
    - 0.293 tonnes garbage per SU x 50,942 = 14,926 tonnes x $125 per tonne (current tip fee) = $1,865,750 lost apartment tip fees

        - 0.293 tonnes garbage per SU x 50,942 = 14,926 tonnes x $170 per tonne (recommended increased tip fee) = $2,537,420 lost apartment tip fees

    - 0.040 tonnes organics per SU x 50,942 = 2,038 tonnes x $75 per tonne = $152,850 lost apartment tip fees

Total system cost to service 50,942 private investment property complex units is estimated at:

- **$2,726,416 (Collection Program Costs)**
- **+ $1,865,750 (Lost ICI tip fees at Otter Lake)**
- **+ $152,850 (Lost ICI Tip fees at Compost facilities)**
- **= $4,745,016 (Annual integration cost at current tip fee rate)**

Integrating private investment property complexes into the residential regime and putting them under HRM service oversight and system monitoring would introduce the following:

- Ensure such properties are provided with proper source separation program infrastructure;
- Ensure waste areas and bins meet by-law requirements for safety, access and cleanliness through contract performance management and penalties;
- Enable direct coordination with private investment property complex firms on waste management initiatives to improve diversion;
- Enhance perception that tenants are seen as residents the same as condo and single house dwellers;
- Improve staff access to and education of tenants;
- Based on pilot project outcomes, would result in increased diversion; and
- Reduce waste service costs for private investment property firms/owners.

Collection service would be based on a similar model to the existing contracts for condo service. This would need to be established through an RFP process. The RFP would have to be developed based on a geographical scan of existing units and properties and sub-divided into zones similar to how the current residential and condo contracts are divided. This option may generate some opposition from private sector haulers.

There would need to be a transition period while the investment properties dealt with existing collection contracts. The increased scope of operations to manage, educate and monitor these properties will also require additional staff resources.

Challenges to incorporating private investment property complexes:

- Budget impact and increased program costs ($4-6 Million/year)
- Opposition from private sector haulers with existing contracts who may lose business;
- Increases the number of condo-like serviced units six-fold (adding 50,942 units to 8,545 condo units currently serviced);
- Creating a contract and service structure that can accommodate the varied needs, size and configuration of the private investment property complexes;
- Scoping out the service requirements;
- Creating the database of private investment property complexes to service;
- Protecting against mixing ICI loads with private investment property complexes loads;
- Illegal dumping at private investment property complex sites;
- Load contamination of waste streams;
- Diversion expectations; and,
- Risk of poor implementation or decreased service satisfaction from tenants and private investment property complex firms.

Appendix 3 – Clear Bag Program Data

In-person consultation feedback identified mixed support and concerns about a clear bag policy. Implementation data across the 30 plus NS municipalities shows prior to clear bag implementation, 70% of residents indicated some level of concern. Following implementation, 85% of residents indicated no level of concern with clear bags. This speaks to the position that concern for mandated clear bags almost disappears once the program measure is implemented. In every jurisdiction where clear bags have been implemented, there has been a measured decrease in garbage tonnage sent to landfill and a corresponding increase in diversion of organics and recyclables.

HRM curb-side monitoring data shows over 75% of multi-member homes use less than 4 garbage bags every two weeks. Curb-side monitoring shows that residents requiring more than 4 bags are not properly participating in source separation.

Both clear bags and reduced garbage bag limits have shown to have immediate and on-going positive impact on increasing diversion of resources for proper processing. When combined with other measures outlined in this report, these measures have resulted in outcomes which support the mature system goals and objectives of the CSC Strategy, 1995.

Figure 13
NS Environment and Labour

Nova Scotia Municipal Clear Bag Program Tonnage reports

	05/06			06/07			07/08		
	Garbage	**Recycled**	**Organics**	**Garbage**	**Recycled**	**Organics**	**Garbage**	**Recycled**	**Organics**
Tonnes	137,778	21,483	25,908	142,917	23,175	28,429	112,603	22,638	39,924

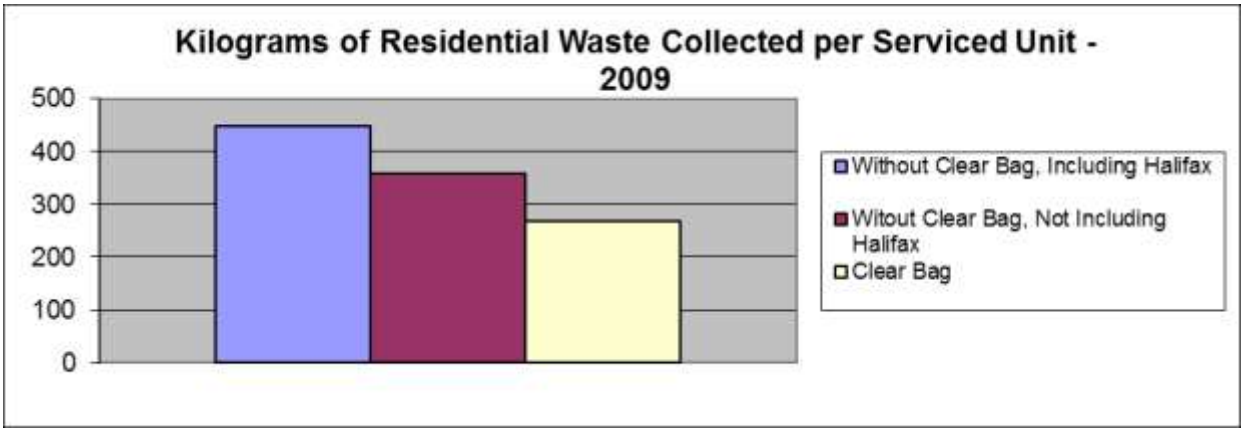


Table 22 - Other Jurisdiction Clear Bag Program Statistics and Outcomes

Region	Clear Bag Implemented	1st Year Garbage Reduction	1st Year Organic Increase	1st Year Recycling Increase
Pictou/Antigonish	**2005**	**26%**	**13%**	**16%**
Valley Waste	**2008**	**16%**	**10%**	**18%**
CBRM	**2010**	**6%**	**4%**	**8%**
Markham, ON	**2013**	**Residential diversion increased from 72% to 81%**		

Summary of HRM staff Clear Bag/Mini-Bin Pilot for IPOANS 2012

At the request of IPOANS members in 2012 SWR staff conducted a pilot project assessing the impacts of clear bags for garbage and organics mini bins in apartment units.

The project included buildings of various sizes throughout Halifax and Dartmouth that were confirmed to house tenants of various demographics, included students, newcomers, and seniors. Some buildings were provided with a year's supply of clear bags for garbage, some were given mini bins for each unit, and some received both.

SWR educators conducted waste audits before starting the pilot to determine the percentage of unacceptable waste currently found in the garbage stream. This is different from diversion rate which is a very different statistic.

Table 23

Location	Pilot	Divertible Waste in Garbage Start	Divertible Waste in Garbage Final	Change
3 Fernhill Rd, Dartmouth	CB/GB	65	23	-42
830 McLean St., Halifax	CB/GB	66	35	-31
Mont Blanc Terrace, Halifax	CB/GB	58	31	-27
1119 Tower Rd. Halifax	GB	69	43	-26
4 Lakefront Dr. Dartmouth	CB	48	32	-16
149 Albro Lake Rd., Dartmouth	CB	60	59	-1
18 Crown Dr., Halifax	CB	47	59	12
6957 Mumford Rd., Halifax	CB	42	58	16
7 Parker St., Dartmouth	CB	61	80	19

Six of the nine properties that finished the project experienced a positive impact from the implementation of clear bags and/or organics containers. The top three performers had both provided to them, followed by the organics mini bin-only property and two buildings that had

just clear bags. The bottom three buildings also had clear bags only provided to them. The data supports the complementary combination of clear bags for garbage and provision of organics bins in each unit as having a positive impact on proper source separation.

Statistical data and operational experience in jurisdictions across NS and other municipalities in Canada confirm clear bags, reduced bag limits and pro-active education, monitoring and compliance measures, supported by effective policy increases diversion and improves source separation.

Appendix 4 – ICI Mass BalanceAnalysis

ICI Sector Stream Waste Components

The ICI sector generates garbage, recyclables, organics and construction/renovation/demolition(C&D) waste streams. Organics and recyclable materials are banned from landfill. ICI C&D materials are governed under HRM By-law L-200 requiring 75% diversion of received materials.

The following table outlines the FY12/13 ICI sector material stream tonnages and total commercial diversion.

ICI System Components	Commercial Tonnages
Refuse	79,331
Organics	16,092
Recycling	6,702
Fibres Private Recycling	43,000
C & D	88,021
Totals	233,147
Diversion (% of Totals)	65.97%

ICI Diversion of Organics

Organics generated from the ICI sector are delivered to the only permitted composting facilities within HRM located in Burnside and Goodwood. These facilities are operated under contract with HRM by Miller composting and New Era Technologies. The facilities are permitted by provincial NS Department of Environment (NSE). Since the organics ban was implemented, the private sector has not developed its own organics processing capacity. There is currently no private sector organics processing identified within HRM jurisdiction for delivery of ICI organic materials banned from landfill disposal.

ICI organics are generated primarily from the following ICI sectors: Grocery retail, Restaurant, Private Investment Property complexes, as well as Large Commercial Retail (i.e. Costco, Wal-Mart, etc...). There is no organic composition data for ICI sector materials arriving at the

compost plants as a result of the service model where collections occur at various locations prior to delivery.

ICI sector organics are scaled and recorded as commercially generated tonnes. In 12/13 there were 16,092 tonnes of ICI organics delivered. Apartments are considered similar to condo units in terms of generation rates. There are 50,900 apartment units in HRM. Based on condo data, organics generation from the private investment properties in the ICI sector is estimated to be 2,036 tonnes.

The ICI sector organics composition is described as primarily wet food waste residue that is nitrogen rich requiring extensive processing. The costs for processing ICI organics are currently not reflected in the tipping fee regime in HRM. HRM organics system costs are approximately $160.00/tonne. The tip fee set for the two organics facilities is $75.00. This equates to a loss of revenues of $1,367,990. This subsidization was established to encourage source separation and diversion from landfill. The tip fee at the landfill is set at $125.00/tonne.

When the organics plants were designed in 1999, the inclusion of ICI organics for processing was envisioned as part of the HRM Waste Management Strategy by way of the "put or pay" clause in the facility agreements. HRM guarantees delivery of a minimum quantity to each facility annually (20,000 tonnes) and inclusion of ICI is recognized as enabling the "put" to be met. The subsidized tip fee remains an initiative to drive organics diversion to these facilities.

ICI Recyclables Diversion

For the past 20 years, there have been 2 primary fibre processors in HRM receiving upwards of 43,000 tonnes of corrugated cardboard and other paper. Recyclables processed by the private sector is driven by market demand and commodity pricing and material can move freely in the marketplace in NS.

In 12/13 the HRM MRF received 6,702 tonnes of ICI blue bag recyclables and lower grade paper. This represented 27% of the total incoming tonnes received at the HRM Recycling Plant. Over the years, the quantity of ICI materials received has fluctuated. ICI recycling tonnage represents an average of 15–30% of total incoming tonnage annually. HRM's strategy originally contemplated the inclusion of private sector processors. The HRM MRF plant does not have the capacity to process all ICI fiber tonnages. To date, HRM has not charged a tip fee for ICI sector recyclables processing.

MRF operating costs, all in, fluctuate based on market pricing for recyclables and range from $15-$54/tonne. If HRM charged a tip fee, based on annual tonnage of 6,700 tonnes, revenues would be:

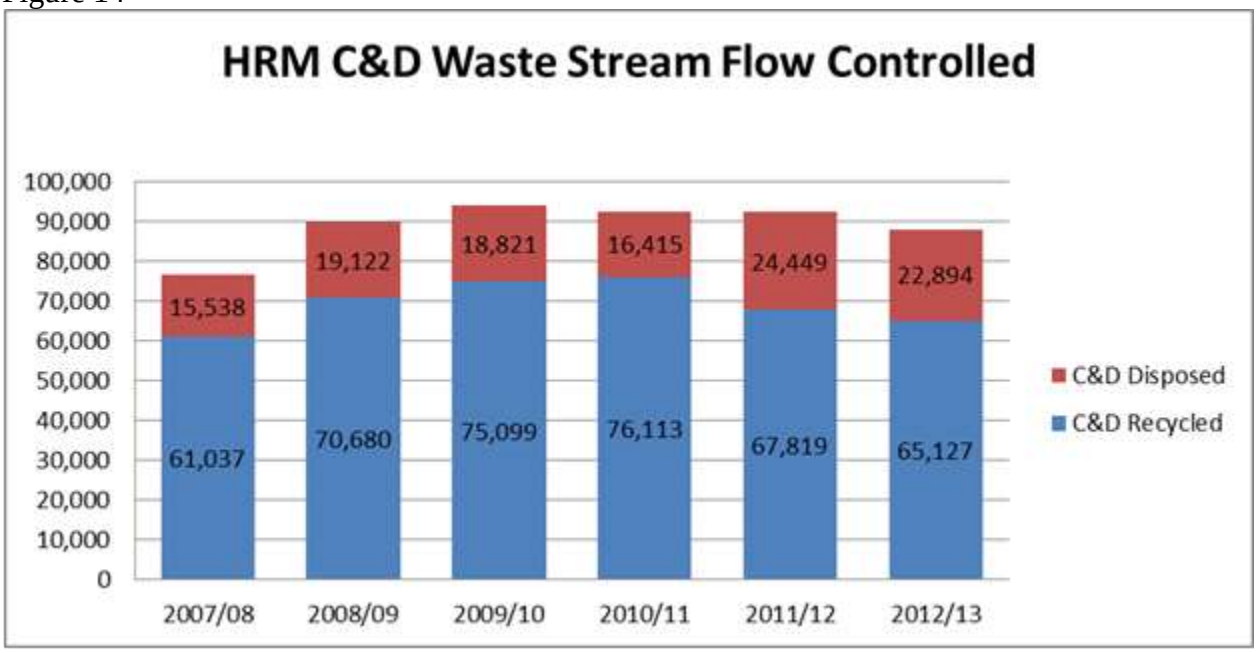
- $25.00 tip fee = $167,500.00
- $50.00 tip fee = $335,000.00

ICI C&D Diversion

C&D materials represent the largest factor in ICI materials diversion at 57% of the total ICI materials diverted away from HRM landfill. ICI C&D materials are governed by HRM By-law L-200 and provincial regulations. Under L-200, licensed C&D facilities are required to divert a minimum 75% of incoming materials away from landfill disposal.

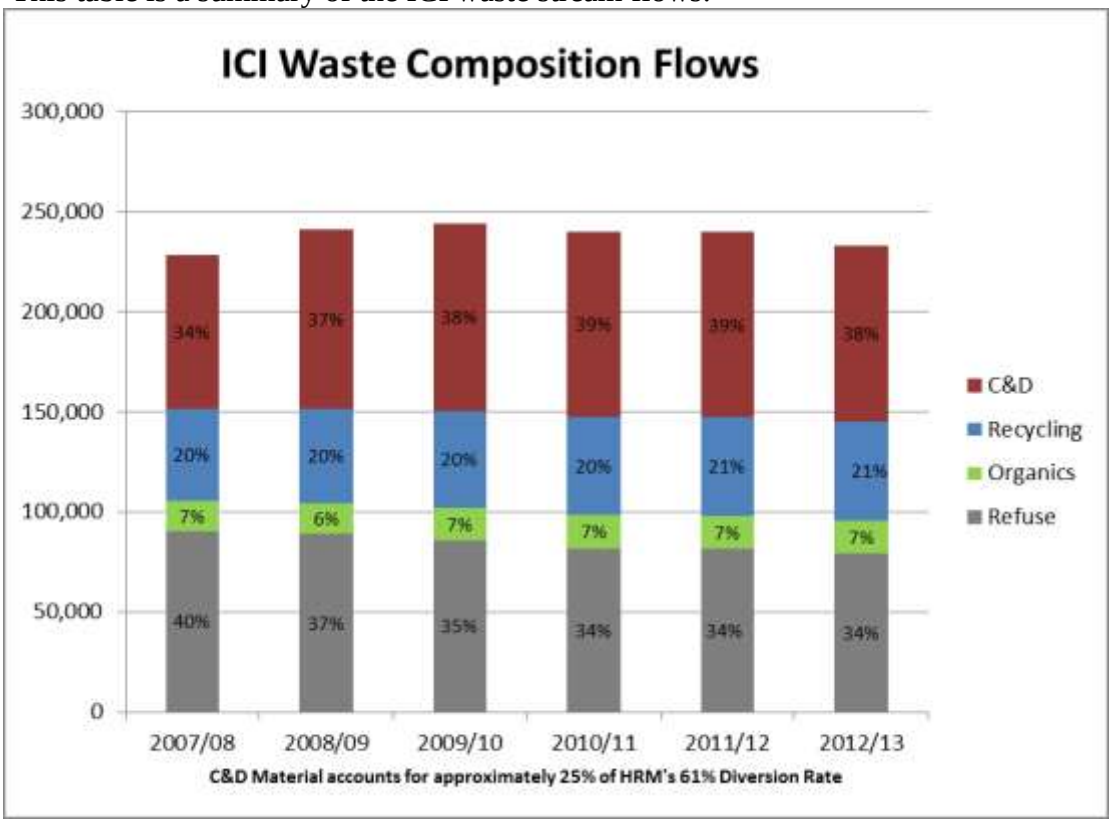
Figure 14 shows HRM C&D Waste stream flows from 2007/08 to present. In 12/13, the private C&D operational facilities (transfer and processing sites) received 88,021 tonnes of C&D and disposed of 22,894 tonnes in the C&D landfill, with the remainder 65,127 tonnes of materials being recycled and re-used.

Figure 14



The 88,021 tonnes of ICI C&D material is diverted away from HRM Otter Lake landfill. The 22,894 tonnes (26%) was disposed of in a private C&D landfill site within HRM. HRM is the only N.S municipality with a C&D strategy, which includes a licensing regime mandating targets for recycling C&D materials otherwise destined for landfill disposal.

This table is a summary of the ICI waste stream flows:

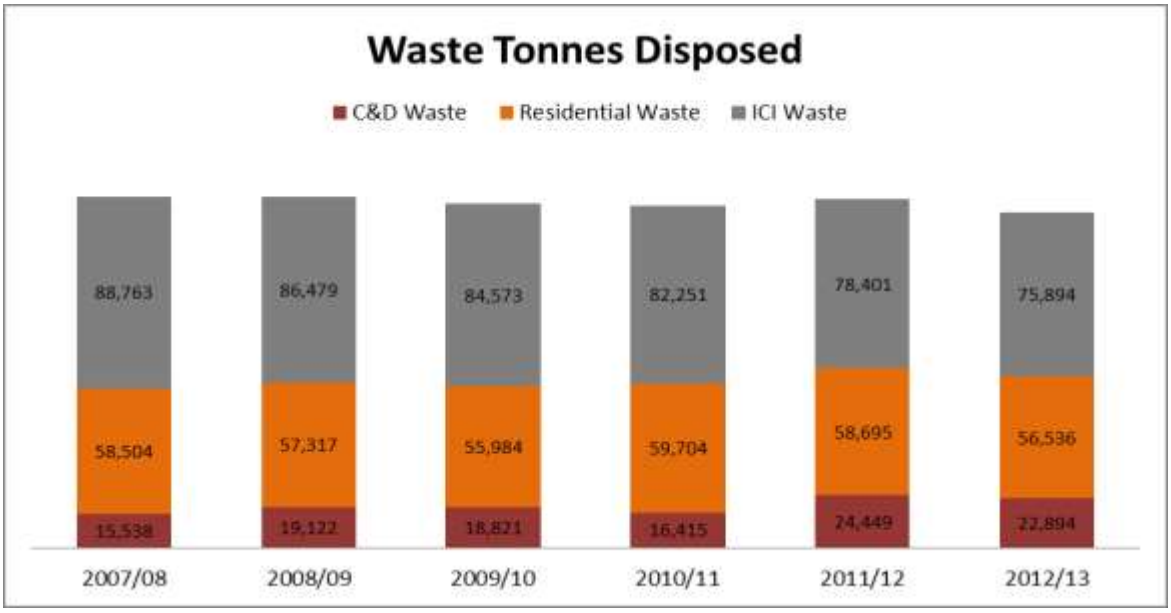


Measuring and Reporting Disposal

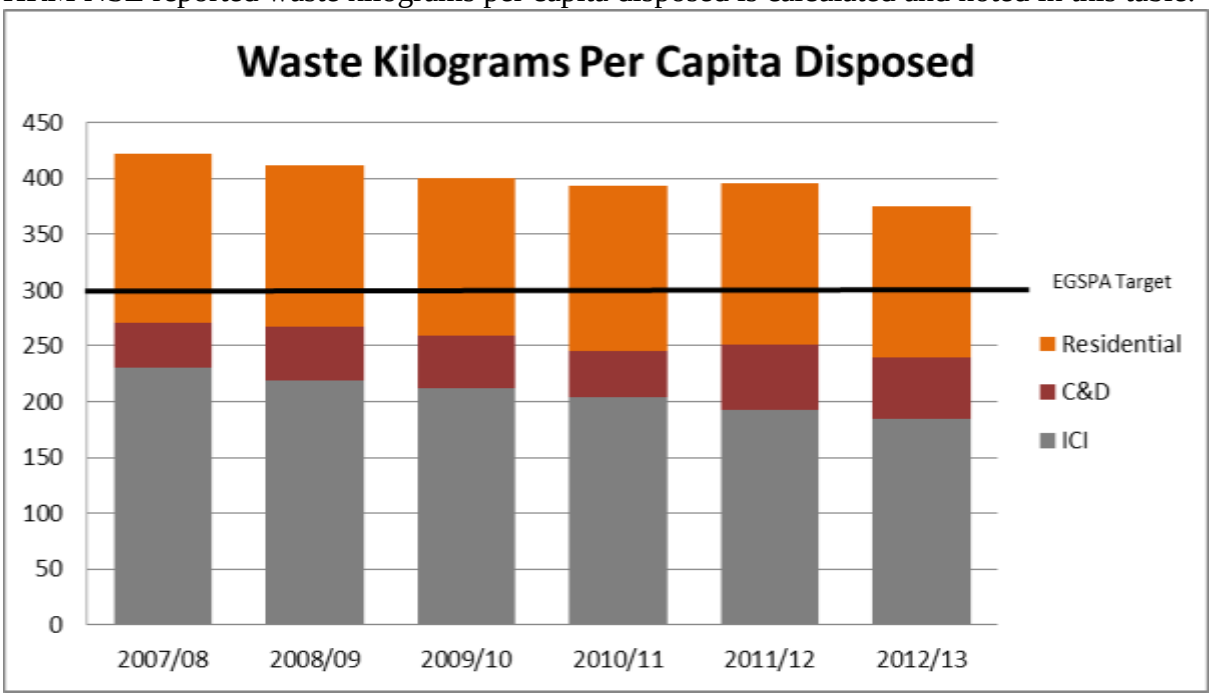
Each year, as mandated by Section 35 (Records and Reports) of the Solid Waste Resource Management Regulations, (NSE requires that municipalities report their municipal waste data. This includes all waste disposed, recycled or received for facility processing. Any waste, ICI or residential, originating from HRM flowing outside of HRM boundaries is required to be reported by the receiving facility as HRM waste for the purposes of measuring disposal and diversion.

This data is reported annually and is a measure of evaluating success in reduced disposal, with diversion of waste attributed to increases in C&D recycling, blue bag and paper recycling and participation in the green cart organics program. The province reports on rates of per capita waste disposal as a provincial measurement toward achievement of reduced waste disposal towards the EGSPA goal of 300 kg. Reporting on tonnes of materials received and disposed originating from HRM is also used for the purpose of calculating funding distributed to the Municipal Regions to support waste diversion programs.

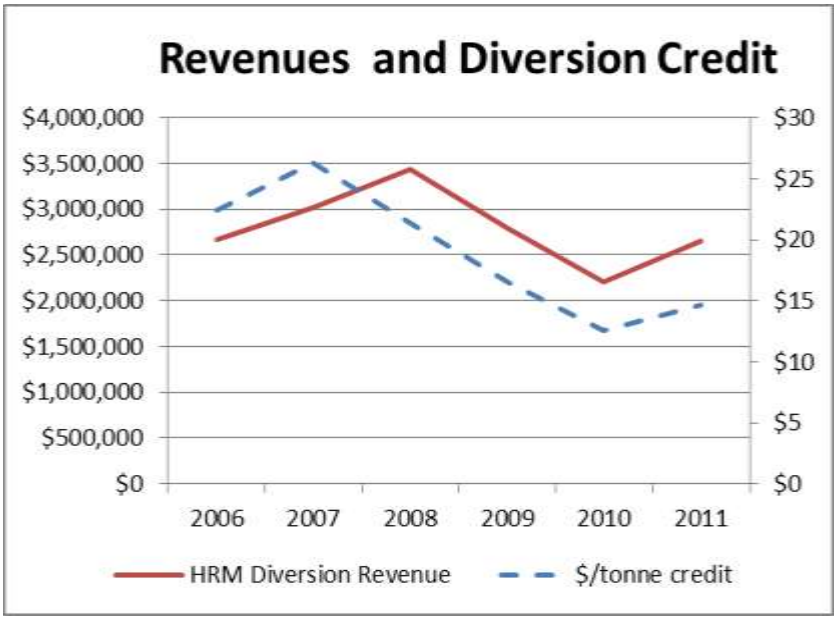
The following figure is a record of the tonnes of C&D, residential and ICI residual waste generated in HRM and delivered for disposal into landfill(s) in HRM. HRM By-law S-600 Section 16 (S-602) prohibits the export of ICI, residential and C&D waste materials outside HRM. ICI and Residential waste is disposed at Otter Lake landfill (orange and grey) and C&D (red) goes to Antrim private C&D landfill.



HRM NSE reported waste kilograms per capita disposed is calculated and noted in this table:



The Provincial Funding agency, the Resource Recovery Fund Board (RRFB) , created by the Province of NS, channels funding from product levies and product stewardship programs to help support municipal waste diversion programs. These are referred to as Diversion Credits issued to municipal Regions based on the quantity of tonnes diverted away from disposal. While the total value of available funding from RRFB has been declining, associated with the current RRFB operating model, HRM revenues are linked to tonnage diverted from landfill.



Allowing the export of residual waste/.garbage will not adversely affect HRM's diversion. Residual waste tonnage delivered to other than Otter Lake landfills will continue to be assigned to HRM. However, the new measures implemented by HRM as outlined in this report should result in improved diversion and compliance. This will increase HRM diversion and increase diversion credit revenues.

Appendix 5 - Evolution of Costs of Residual Garbage

This table shows 1996/97 and comparison to inflated costs based on CPI to 2012 which were used to develop the cost analysis for this report.

Table 25

	Cost per Tonne	Tonnes	Total Estimated Cost
1996/1997 Integrated Waste Resource Mgmt. Strategy Report (Low Range)	$66.78	250,000	$16,694,500
Inflation Adjusted to 2012 @ Canada CPI (Low Range)	$91.42	250,000	$22,854,001
1996/1997 Integrated Waste Resource Mgmt. Strategy Report (High Range)	$87.80	250,000	$21,950,500
Inflation Adjusted to 2012 @ Canada CPI (High Range)	$120.20	250,000	$30,049,222
1996 Revised Integrated Waste Resource Mgmt. Strategy Report	$116.62	262,400	$30,600,000
Inflation Adjusted to 2012 @ Canada CPI	$159.64	262,400	$41,889,989
Actual Operating and Reserve Transfer (Capital) Cost 2012/13	$201.28	270,598	$54,465,625

Figure 16 shows just the landfill costs per tonne. Figure 17 shows the comparison, low to high, of the initial assessed system costs, the revised plan system cost estimates and the current system costs based on the annual tonnages used to make the assessment back in 1996 in a cost per tonne comparison.

Figure 16

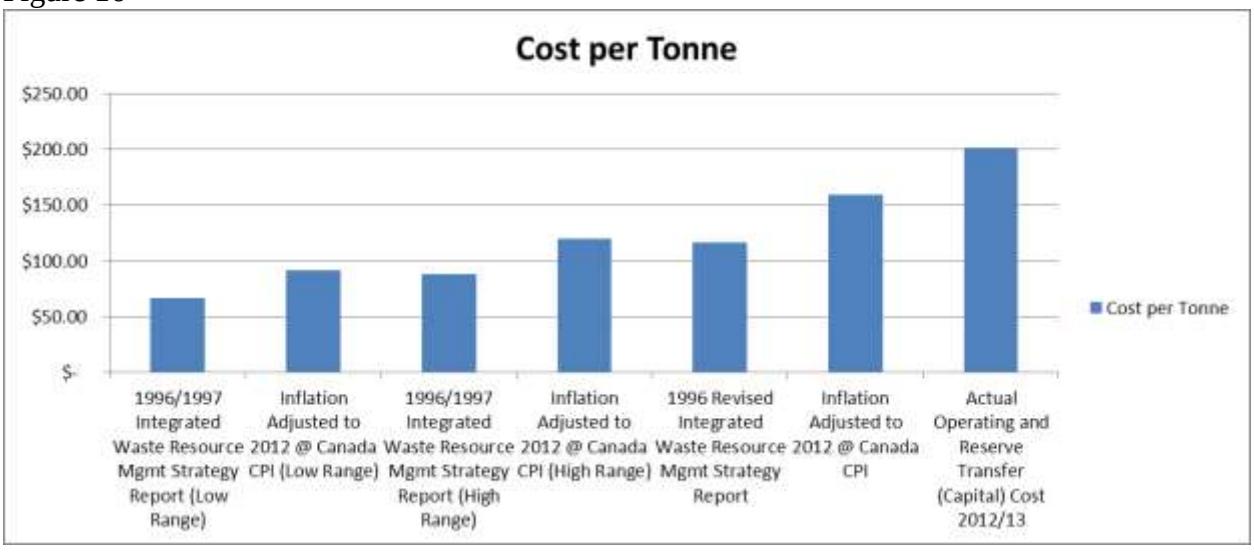
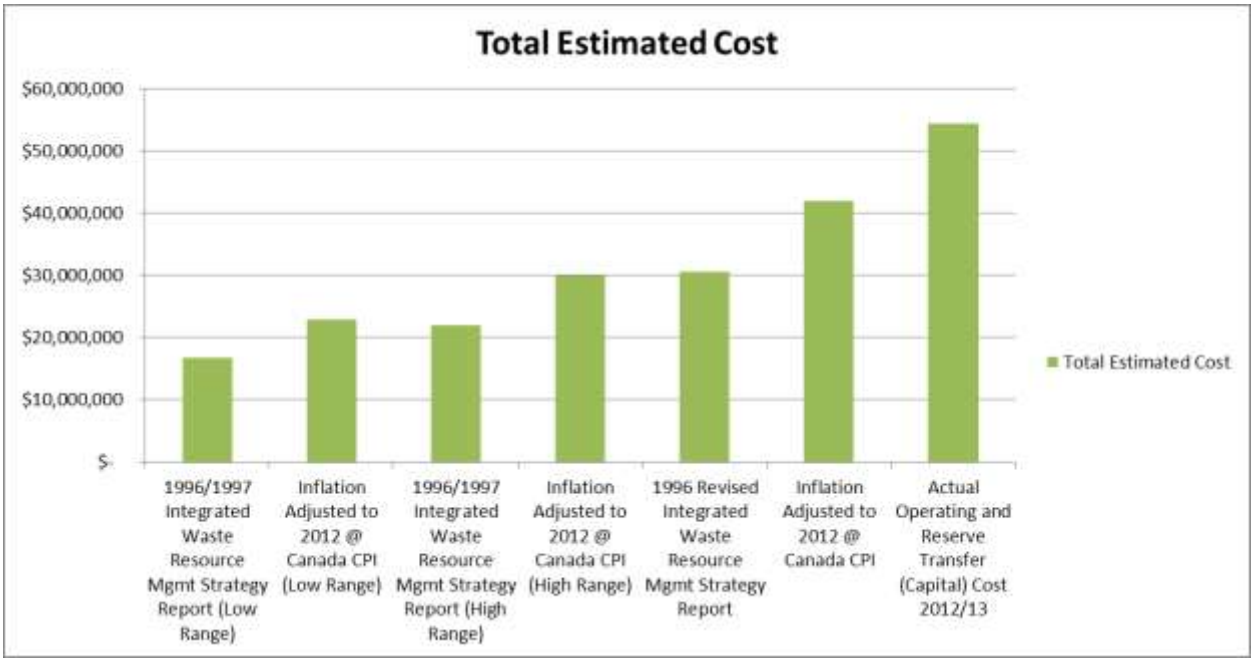


Figure 17 shows the comparison in terms of total system costs.

Figure 17



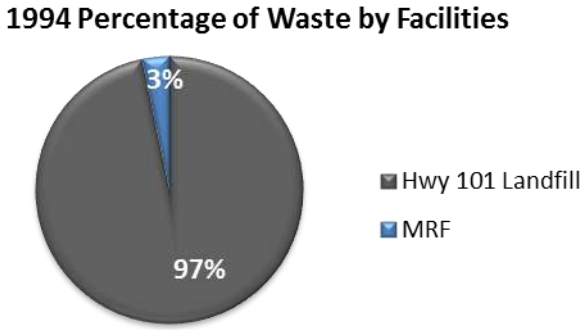
This data illustrates that both in cost per tonne or total system costs, the revised ISWMS 1997 plan resulted in system costs much higher than anticipated and an outcome opposite to the CSC Strategy vision.

Appendix 6 – System Performance Report Card and Diversion Pie Charts

The Changing Waste Stream at HRM's Landfills

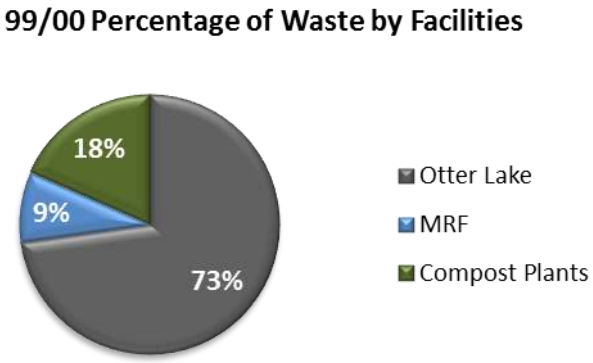
In 1994, when the CSC Integrated Waste/Resource Management Strategy was being developed, 97% of Halifax County's waste stream went to the Highway 101 landfill.

Figure 18



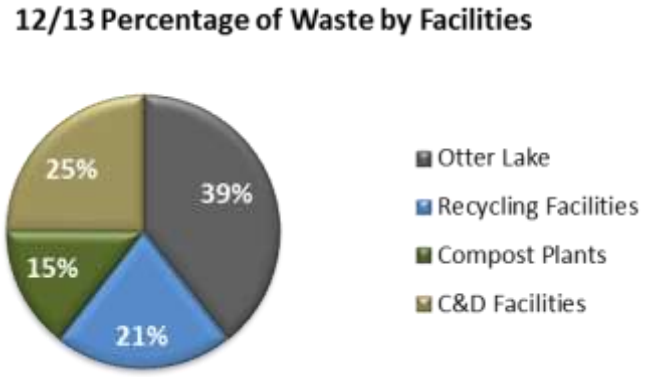
By the year 2000, there was increased recycling participation; the compost facilities were operational; Otter Lake was the site of HRM's new landfill and received 73% of HRM's waste stream.

Figure 19



A decade later, more attention has been paid to diverting C&D material; more materials have been added to the recycling stream and participation in diversion programs has grown, such that only 39% of HRM's waste stream arrives at the Otter Lake Waste Processing facility. See pie chart below, Figure 20.

Figure 20

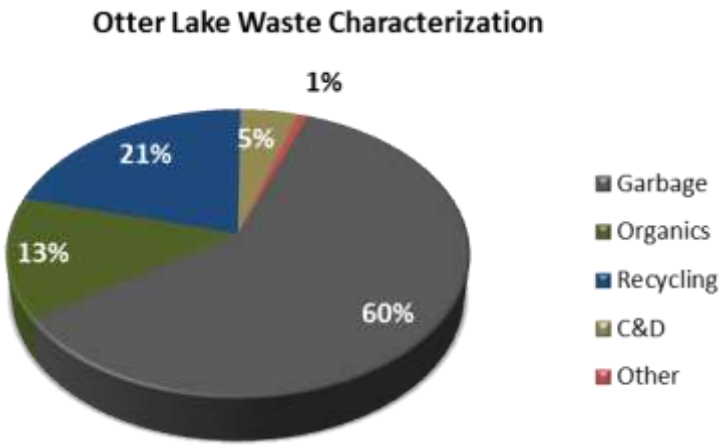


As you can see, over the years, HRM's waste has changed from a waste stream to a waste/resource stream, with the resources funneled off to their appropriate processing facilities.

Figure 21

However, as noted below, there is still more work to be done. 40% of the material that are delivered to the Otter Lake site A facility should have been source separated and delivered to other processing facilities.

Figure 22


Otter Lake Waste Characterization
1%
5%
21%
13%
60%
Garbage
Organics
Recycling
C&D
Other

Appendix 7 – Functional Analysis of the FEP/WSF

System Functionality Analysis of the FEP/WSF

The contract with MIRROR NS included the design, construction and operational plan for Otter Lake, for which Provincial approval was required. There is no legislative requirement for the FEP or WSF and no other landfill in the province or which can be identified in Canada, uses similar machine processing prior to disposal. In fact, as MIRROR NS noted when they submitted the revised 1997 plan to Regional Council, they were unable to identify any other facility in the world which used machine processing prior to disposal in a landfill.[28] Stantec confirmed in their report that they were unable to identify another facility utilizing a similar operating model.

The MIRROR contract stipulates that all putrescible organics must be stabilized in the WSF prior to being placed in the landfill. Statistical data analysis by both CBCL and SNC Lavalin, as outlined in Figure 23 below, shows that a third of the putrescible organics currently arriving at the landfill do not go through the WSF.

Figure 23

CBCL Ltd. Otter Lake WSF Materials Characterization and Testing
December 2012 and January 2013

Summary of APPENDIX B - Physical Composition of Wastes Entering WSF (Three 100 kg Samples)

Component	Percentage
Organic Material	66%
Other Material	34%
Total	100%

SNC Lavalin Environment Halifax Regional Municipality Solid Waste Characterization Study
Otter Lake Waste Facility 2009

Summary of Tables 3-1 and 3-2

Component	Percentage
Organic Material	18%
Other Material	82%
Total	100%

Material Characterization Analysis Applied to Determine the Weight of the Materials that Entered the WSF January to December 2011

Component	Percentage	Tonnes
Organic Material	66%	16,600
Other Material	34%	8,500
Total	100%	25,100

Material Characterization Analysis Applied to Determine the Weight of the Materials that Entered the FEP January to December 2011

Component	Percentage	Tonnes
Organic Material	18%	25,000
Other Material	82%	114,300
Total	100%	139,300

Material Characterization Analysis indicates approximately 25,000 tonnes of organic material enters the FEP and approximately 16,600 tonnes of this organic material enters the WSF, so the remainder of the organic material, approximately 8,400 tonnes, goes to the Landfill without being processed through the WSF.

SNC Lavalin Environment Halifax Regional Municipality Solid Waste Characterization Study
Otter Lake Waste Facility 2009

Organic Component	Percentage	Tonnes
Food Waste	14%	19,400
Yard Waste & Boxboard	4%	5,600
Total	18%	25,000

Material Characterization Analysis Applied to Determine the Weight of the Materials that Entered the WSF January to

Component	Percentage	Tonnes
Organic Material	66%	16,600
Other Material	34%	8,500
Total	100%	25,100

Material Characterization Analysis indicates approximately 19,400 tonnes of food waste enters the FEP and approximately 16,600 tonnes of organic material enters the WSF, so at least approximately 2,800 tonnes of food waste goes to the Landfill without being processed through the WSF.

[28] Metropolitan Halifax Solid Waste/Resource Management System Implementation Plan, MIRROR Nova Scotia, page 7, September 15 1995.

These putrescible organics go straight to the RDF following processing in the FEP. This data proves that in terms of system performance, a significant percentage of putrescible organics enter the landfill without stabilization. This outcome is contrary to the contract and the CMC agreement that only approved waste will be placed in the landfill. The status quo situation is not compliant. However, the operational measures at the RDF are effectively dealing with the putrescible organics that are not stabilized through the WSF.

In addition to un-stabilized putrescible organics going to the RDF, another functional outcome of the FEP/WSF processing is the introduction of fugitive GHG escaping into the atmosphere. The issue is whether or not the assessed benefits from the stabilizing of 2/3 of the putrescible organics arriving at Otter Lake outweighs the negative environmental impact of fugitive GHG entering the atmosphere as a result of the machine processing?

All parties {Dillon, Arnold, Stantec and SNC Lavalin} agree that the shredding and stabilizing of the mixed organics and garbage waste materials, upwards of 25,000 tonnes per year, through the WSF reduces the material's gas potential. However, what Stantec and SNC Lavalin also identify is that the processing through the WSF unintentionally introduces a methane gas impact to the environment. The process generates increased volumes of GHG in the early years of cell operation before optimized GHG collection systems can be installed following cell closure.

Environment Canada's website states:

- Methane is 21 times more potent than carbon dioxide in terms of its global warming potential.
- Emissions from Canadian landfills account for 20% of national methane emissions.
- Estimates have shown that approximately 27 Mega tonnes (Mt) of carbon dioxide equivalent (eCO_2) are generated annually from Canadian landfills, of which 20 Mt eCO2 are being emitted annually.[29]

The illustration below (Figure 24) shows gases captured and not captured in a traditional landfill. A traditional landfill does not pre-process, shred and stabilize into a dry fluffy material putrescible organics mixed with garbage {outcome from the FEP/WSF}. Captured and managed methane gases are below the dashed line. Fugitive gases which escape into the atmosphere are those above the dashed line in the dark shaded area. This graphic illustrates the gases presenting before cells are properly capped and sealed. Even when the cells are sealed, methane continues to escape.

[29] http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=6F92E701-1, January 24, 2013.

Figure 24

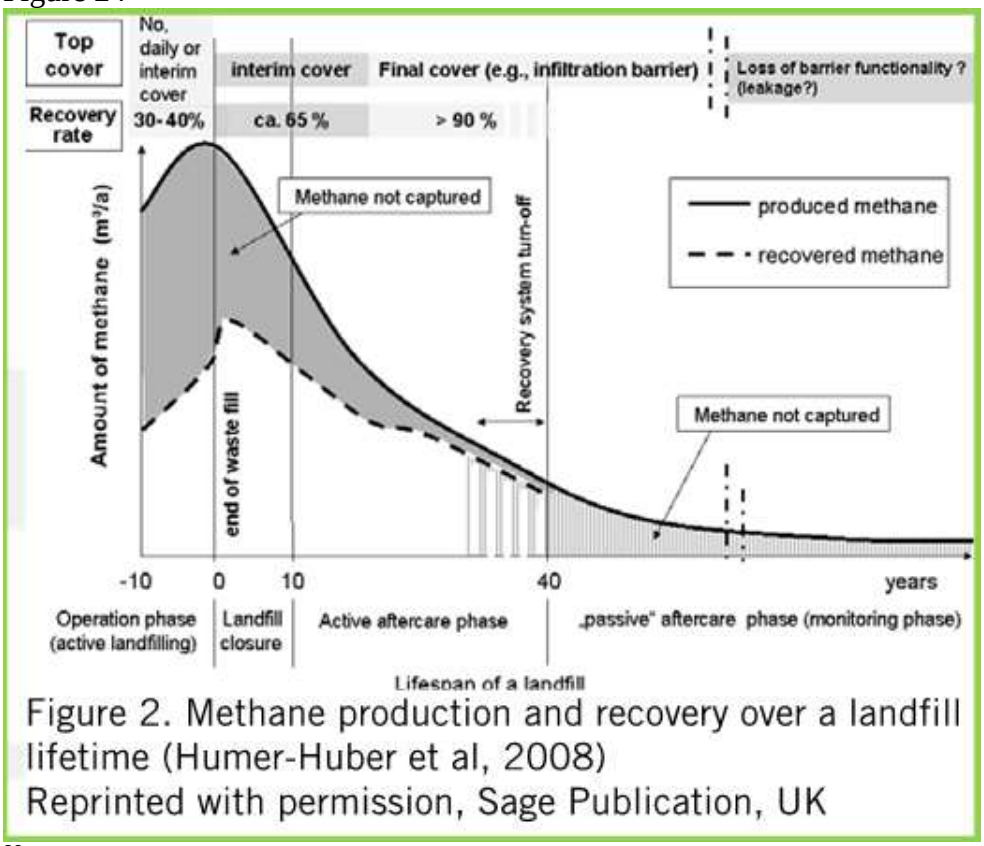


Figure 2. Methane production and recovery over a landfill lifetime (Humer-Huber et al, 2008)
Reprinted with permission, Sage Publication, UK

[30]

The following graph shows a comparison between a bio-reactor landfill and a traditional landfill with no waste processing. A bio-reactor landfill utilizes a process similar to the process undertaken in the WSF to "generate" decomposition through introduction of air, heat and moisture to accelerate decomposition. As shown, the processing of materials significantly accelerates and shortens the duration of substantial gas production.

[30] http://compostactivist.com/Activist/PoliticalObstacles/MethaneGas.aspx, 25 November, 2013.

Figure 25

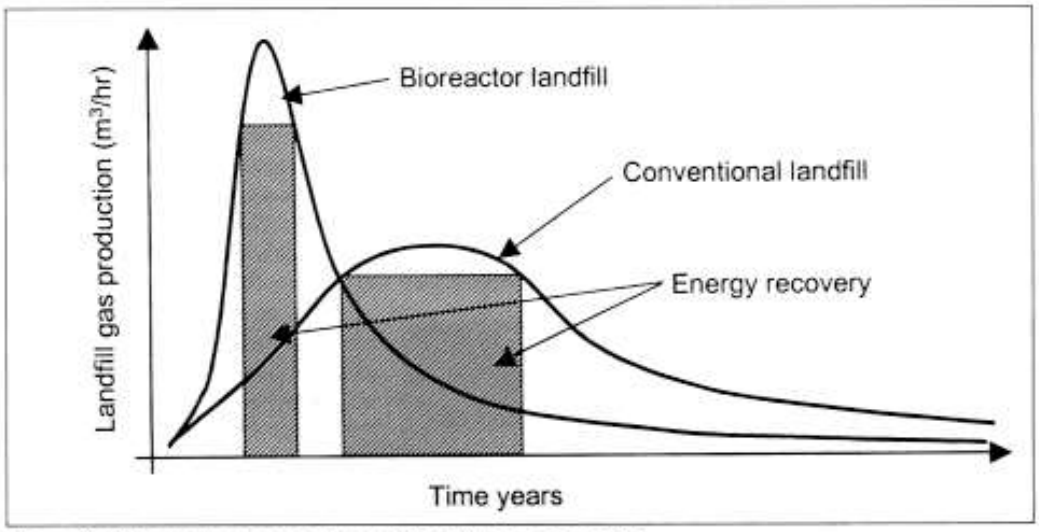
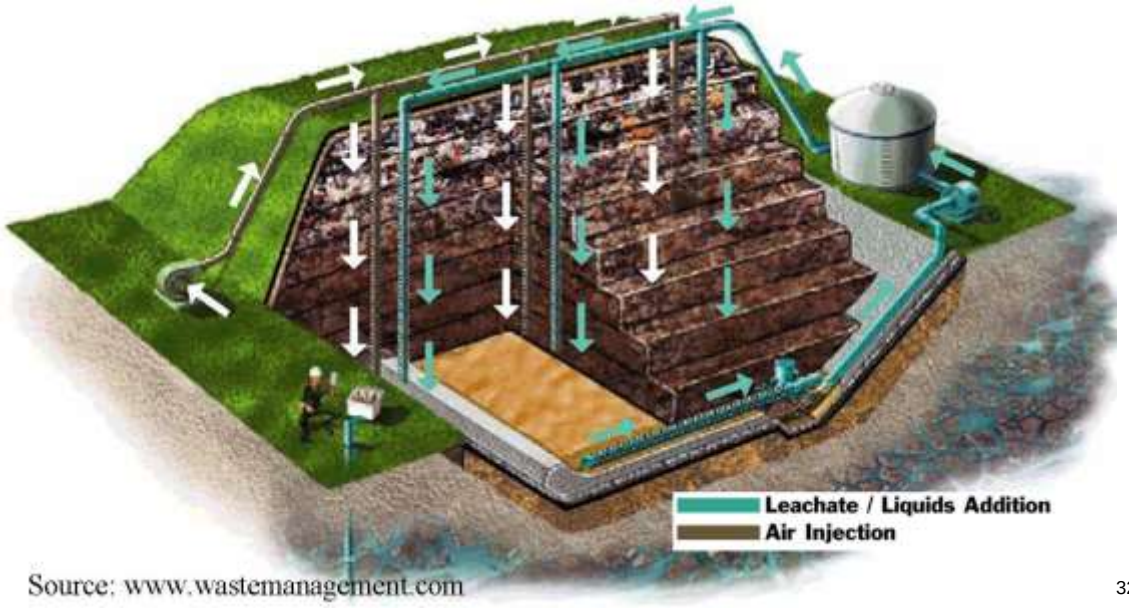


Figure 2: Schematic representation of landfill gas generation [31]

The following is an image of a bio-reacotr landfill.
Figure 26



[32]

The above image depicts a managed gas production bio-reactor landfill. The current processing of the organics garbage mixture at Otter Lake to stabilize the putrescible organics through the WSF can be compared to the process utilized to rapidly generate decomposition in a bio-reactor landfill. The waste materials are saturated to desired levels, and air and heat are introduced to accelerate decomposition.

[31] http://oldweb.northampton.ac.uk/aps/env/Wasteresource/2000/Mar2000/2000mar25_3.gif
[32] http://www.wm.com/sustainability/bioreactor-landfills/bioreactor-technologies.jsp

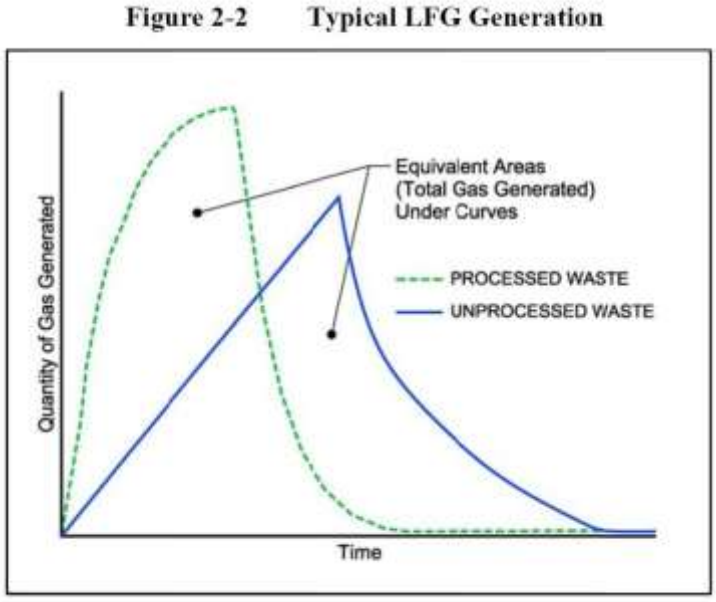
Over the 15-18 days in the WSF, the materials release a percentage of their gas potential.[33] The remaining gas potential is released once the stabilized materials are placed in the landfill. A critical difference between the two systems is that in a bio-reactor landfill, the landfill cells are sealed prior to the application of measures to accelerate decomposition. The gases released from the process are then captured to generate renewable energy.

At Otter Lake, the putrescible materials are processed through stabilization in the WSF prior to being placed in the open landfill cell. The gases generated during the stabilization process are released through a bio-filter adjacent to the WSF which acts as a filter to manage odours. Then the stabilized materials are placed into the landfill and mixed with the other garbage.

As noted above, when re-introduced to oxygen, moisture and the atmosphere, decomposition continues at an accelrated rate. This is what produces the gases and odours managed by the temporay gas management system.

Below is the graph utilized by Dillon Consulting Limited to illustrate the gas production curve as a result of the processing, shredding and stabilizing of the organics through the WSF at Otter Lake. Once the putrescible organics and garbage mixture comes out of the WSF and are placed in the landfill, decomposition results in the remaining gases being produced much faster. In the case of Otter Lake, based on the previous graphs, given the placement in an active uncapped cell, the majority of methane gases from the organics would escape as fugitive gases into the atmosphere or be captured by the temporary gas management system and burned off.

Figure 27



[34]

[33] Memo, Subject: Waste Stabilization Facility (WSF) Evaluation and Comment on Stantec Inc. & SNC-Lavalin Inc. Reports, *Bio-Logic Environmental Systems, Dr. P Arnold, 16 September, 2013*

[34] Waste Resource Strategy Update Document Review Report, May 2013, Procured by MIRROR Nova Scotia, Submitted by: Dillon Consulting Limited, page 11.

Arnold, Dillon, MIRROR NS and CMC maintain the FEP/WSF process is required to protect the environment and community. Stantec and SNC Lavalin agree that the processing reduces gas potential in the materials but also produces rapid generation of gases once placed in the landfill. The two outcomes are fugitive GHG and a reduced number of years that GHG must be managed. From an environmental stewardship perspective, as is shown in the first gas production graphic, the shredding and "stabilizing" of mixed organic waste materials and subsequent placement into an active cell will result a significantly higher percentage of GHG being released into the atmosphere before a cell is sealed.

What Stantec and SNC Lavalin have suggested was that the FEP/WSF mechanical processing introduces a negative environmental impact in rapidly generated fugitive GHG. The question is whether or not the more rapid generation and release of GHG prior to cell closure is an acceptable environmental impact? An alternative, as has been suggested by Stantec and SNC Lavalin, are more rigorous operational management practices at the RDF cell to achieve similar operational outcomes in terms of no community impacts. HRM could introduce other ISWMS changes as outlined throughout this report to increase diversion and further enhance environmental or community protection to address concerns of placing materials directly into the RDF.

Appendix 8 – Cell Increase in Height Implications

Landfill Cell Height

The current cell height protocol is consistent with original site planning. The nine cell plan for Otter Lake will reach capacity in 2024. However, the existing nine cell plan at Otter Lake could be extended by almost 25 years with an addition of 15 meters in height to each cell. This analysis includes adding additional materials on top of closed cells (1-5) once the current active cell, 6, reaches capacity. Cells 7-9 would subsequently be developed to the new height protocol. Staff is working on a digital representation of what this height increase would look like from various angles.

Industry standard is to build landfill cells as high as practical to realize maximum return on the capital investment in the cell liner construction cost. The vast majority of cost for a landfill cell is in the construction of the cell liner mold. Cell 6 cost $16.1 million as approved by Regional Council. This figure does not include the cost of the Borrow Pit Road ($ 944 K) project associated with the construction of cell 6.

Programmed capacity for cell 6 is approximately 500,000 tonnes for a $32.20/tonne capital investment expense. Increasing cell 6 height by 15m doubles the cell's capacity to approximately one million tonnes. This results in a reduced capital investment cost of $16.10/tonne. Current amortization is based on a cell life of 3.5 years on a projection of approximately 140,000 tonnes/year. The additional cell height doubles the cell life and doubles the amortization period to 7 years.

The only Provincial legislative criterion for siting cells at the Otter Lake site relates to distance from a well servicing a residence. According to Provincial legislation, cells must be a minimum of 1000m from the nearest well servicing a residence. The cells at Otter Lake exceed this Provincial regulation by over 2000m as per the CSC strategy recommendation that cells be no closer than 3000m from the nearest well servicing a residence. This is depicted in Appendix B.

The environmental consideration of the recommended increase in cell height would be a drumlin mound 15m higher than the existing drumlin mound at the site. The current site plan requires remedial restoration through the planting of trees, shrubs and other local vegetation. The intent of the remedial work would be to return the site topography to be consistent with local surroundings. Given the topography of the area and the existence of hills and ridges, the increased height of the resulting drumlin mound is assessed to have limited impact on this objective.

The recommendation to increase cell height is further supported when the capital investment already made in the existing cells on site is taken into consideration. Cells 1 through 5 are already built and paid for. Each cell which is added to in terms of 15m of additional materials has the ability to push out the requirement to build the next cell by several years. Each extension of time before the next cell is required also extends the life of the site, should Regional Council so choose.

Implementation of these operational site model changes will require development of a new operating plan to build on existing closed cell. Preliminary analysis from the consultant in terms of a draft operating plan indicates that this option is entirely practical when compared to existing and ongoing site management.

The addition of added height on cells with no identifiable environmental impact increases the economic sustainability of the development of cells at Otter Lake. This change also introduces over 20 years of projected annual capital budget savings as noted below in Table 26. The key point in this representation is that these are not discretionary potential budget avoidance savings. These capital dollars would have to be spent to fund future cells which are already in the long range forecast budget to support cells 7-9.

Table 26

Cell Height Scenario's Projected Capital Budget Cost Avoidance

Cell Height Increase	Resulting Year The Next Cell Would Need to be Built	Projected Budget Savings / Cost Avoidance
15m	2034 - 2036	$ 114M - $ 117M
10m	2029 - 2031	$ 74M - $ 82M
5m	2023 - 2024	$ 36M - $ 43M
Current	2016	$0

It should be noted that this site extension is based on the technological situation as it exists today. The waste management industry is evolving very quickly with new technologies. The implementation of this option to extend cell height and site capacity gives Regional Council the opportunity to have a secure, fiscally sustainable solution well beyond the planning horizon when other waste industry technology options may dictate alternatives to landfilling.

The site extension discussion was included in order to explain the order of magnitude of the opportunity the Otter Lake site represents to the region for HRM's waste management system. Regional Council is the sole authority in terms of approving cell height. The current protocol is a product of the initial site plan. As previously noted, there are no Provincial legislative or regulatory restrictions on cell height. The recommended height change poses no increased risk to the environment. The increase in height supports the achievement of the original CSC vision objective of a fiscally sustainable 100 year waste management solution for the region.