HALIFAX
REGIONAL MUNICIPALITY

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Item No. 8
Halifax Regional Council
23 March 2010

TO: Mayor Kelly and Members of Halifax Regional Council

SUBMITTED BY: Phillip Townsend, Director, Infrastructure and Asset Management

DATE: 5 March 2010

SUBJECT: The Natural Step

INFORMATION REPORT

ORIGIN

This report originates from Staff in response to several inquiries from members of Regional Council on The Natural Step.

BACKGROUND

In the early 2000's, Halifax Regional Council established four corporate themes: Safe Communities; Excellence in Governance; Excellence in Service Delivery; And, Healthy, Sustainable, Vibrant Communities. These themes carried over from the community visioning work that preceded the Regional Plan, that clearly emphasized a commitment to environmental sustainability.

The four pillars of sustainability include: Fiscal, Environmental, Social and Cultural. Under the Environmental pillar, HRM has taken an integrated approach to environmental sustainability with our Clean Land, Clean Air, Clean Energy, and Clean Water policies, plans and strategies.

In 2004, the Sustainable Environment Management Office was created as the corporate lead on environmental sustainability. One of the initial projects that SEMO worked on was partnering through relationships established through the Federation of Canadian Municipalities to engage with The Natural Step to conduct a Corporate Sustainability Analysis.

That project initiated a relationship between HRM and The Natural Step (www.thenaturalstep.org). This report outlines some of the actions delivered from that relationship.

DISCUSSION

The Natural Step Framework addresses the need for a systematic way of understanding and planning toward sustainability. It is a methodology for planning that provides a science-based understanding of sustainability together with a tested planning approach to translate that understanding into practice. It helps create a common perspective and language for sustainability. It defines sustainability at the principle level, which enables organizations to create optimal strategies for dealing with the present day situation and move strategically toward sustainability.

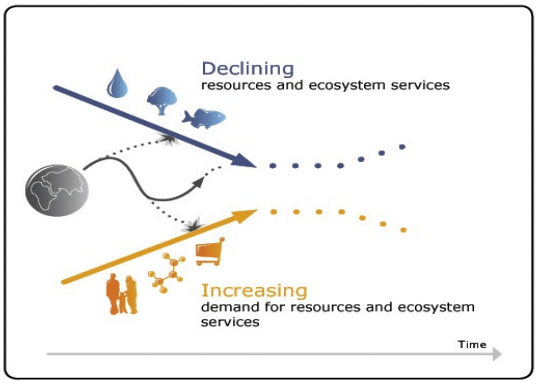
The framework has the following main components:

- The Funnel as a Metaphor
- The Sustainability Principles for a Sustainable Society
- Backcasting from Principles
- A Four-stage ABCD strategic planning process

Overview of Framework

The Funnel

In the quest for good health, welfare and economic prosperity, we are systematically destroying the system that we, as humans, are completely dependent upon - nature. Life-sustaining natural resources, such as clean air and clean water, are subject to increasing deterioration due to human activity. Forests are being lost and species extinction is gathering pace. At the same time, nature's long term productivity capacity is being degraded in fields, forests and oceans. The reason for nature's reduced productive potential is that we are polluting and displacing nature in various ways. Renewable resources are being used up at such a rate that nature does not have time to build new ones. At the same time, there are more and more people on earth in need of these resources, and per-capita consumption is increasing. It is as if all civilization is moving deeper into a funnel whose narrowing walls demonstrate that there is less and less room to manoeuver, in order to avoid "hitting the wall".



Four Sustainability Principles

The earth is a sustainable system. Scientists agree that human society is capable of damaging nature and altering life supporting ecological structures and functions in only three major ways. Based on this scientific understanding, The Natural Step has defined three basic sustainability

principles for maintaining essential ecological processes. In addition, social and economic dynamics fundamentally drive the actions that lead to ecosystem changes. Therefore, the fourth sustainability principle focuses on socio-economic dynamics and affirms that meeting human needs worldwide is an integral part of sustainability.

In a sustainable society, nature is not subject to systematically increasing:
1. Concentrations of substances extracted from the earth's crust;
2. Concentrations of substances produced by society;
3. Degradation of nature by physical means;

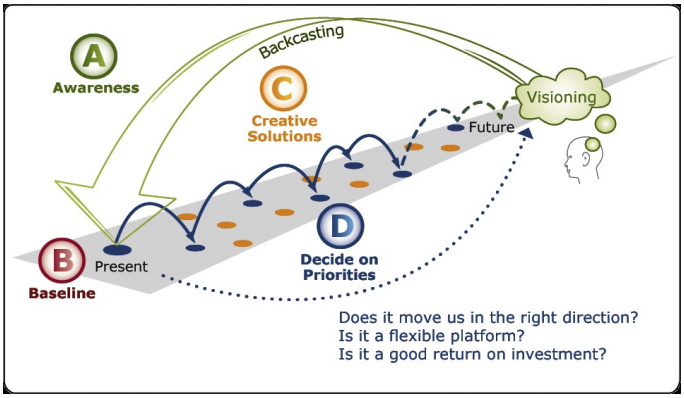
And, in that society, people are not subject to conditions that systematically:
4. Undermine their capacity to meet their needs.

Backcasting from Principles

The Natural Step Framework uses a planning approach called "Backcasting from Principles". Baskcasting is a methodology for planning that involves starting from a description of a successful outcome, then linking today with that successful outcome in a strategic way.

The ABCD Planning Process

The sustainability principles describe the basic requirements that must be met in a sustainable society. The Natural Step has an approach to provide a systematic way of guiding this.



(A)wareness: Understanding sustainability and the TNS Framework as a shared model
(B)aseline: An assessment of today is conducted by listing all flows and practices that are contributions to violations of the four sustainability principles, as well as considering the assets in place to deal with the issues.
(C)ompelling Vision: Possible solutions and innovations for the future are generated and listed by applying the constraints of the sustainability principles to trigger creativity and scrutinize the suggested solutions.
(D)own to Action: Priorities are made, and smart moves are made and concrete programs for change launched. Innovative actions are prioritized by screening them through the following three questions:

1. Does this measure move us in the right direction?
2. Does this measure provide a flexible platform for future improvements?
3. Is this measure likely to produce return on investment soon enough to fertilize the further process?

Corporate Sustainability Analysis
The 2004 Corporate Sustainability Analysis (Reference One: http://www.halifax.ca/environment/documents/SustainabilityAnalysisSeptember2004.pdf) identified twelve high level corporate wide recommendations. These recommendations were distilled into three immediate priorities:

- Green Corporate Culture
- Green Buildings
- Green Procurement

Numerous initiatives have been completed and are ongoing to address these priorities. Examples of results include the LEED standard on new construction, the approximately $7 million of energy efficiency projects executed, awards for Leadership in Green Procurement in 2008 and 2009, The Sustainable Transition Team, and Corporate Sustainability Training. It is the plan of SEMO to review the corporate sustainability analysis, and update it, in 2010 / 2011.

Sustainable Transition Team
Established in June 2007, with a fundamental mandate to green the corporate culture through the promotion of sustainability practices, policies, education and awareness, the team included representatives from: Planning, Cultural Affairs, Procurement, Police, Fire, Facility Services, Municipal Operations, Facility Development, Economic Development, CAO's Office, Strategic Transportation Planning, Fleet Services, and SEMO.

By taking a decentralized approach to sustainability, and getting responsible staff out of our traditional departmental silos, we witnessed transformational progress in short time. Some results of the Team included:

- Participation in the Atlantic Canada Sustainability Initiative
- Creation of a draft sustainability filter
- Delivery of corporate sustainability training

The Team has been functionally dormant since late 2008, with the retirement of the former manager of SEMO, however has provided the informal relationships to catalyze some of the sustainability initiatives we have continued to deliver. In the 2010 / 2011 SEMO business plan, there are plans to re-engage the Sustainable Transition Team with the mandate to deliver a Corporate Sustainability Report to compliment the Corporate Reporting Program lead by BPIM. Additionally, Internal Service Requests have been generated to add Recreation Services and Solid Waste Management to the Team.

Sustainability Filter
Following the initiation of a corporate sustainability filter from the Sustainable Transition Team, staff worked with The Natural Step to devise a practical filter to apply in our corporate decision making processes. This work culminated in a number of pilot projects and a revised filter (Attachment Two) in 2009.

Initial findings are that the filter needs more work to enable practical application. Generally, with a staff of planners, engineers, designers, accountants, etc., we think differently - and the one size fits all tool cannot be too precise or it will stifle or scuttle the decision making process. Staff are continuing to work on the filter, particularly collaborating with other similar organizations (i.e., municipalities) in refining the usage and application of the Filter. This is an ongoing work in process that we continue to progress.

In the summer of 2009, Regional Council approved a Green Vehicle Filter which was an offshoot of this filter development process.

The SEMO 2010 / 2011 Business Plan includes continuing to pilot the filter specifically in the Capital Planning Process with the Asset Leads. Staff will be back with an update on the Sustainability Filter later in 2010.

Atlantic Canada Sustainability Initiative

The ACSI was a collaborative project designed to build capacity and momentum around sustainability in Atlantic Canada using The Natural Step framework as a guide. It was developed by a grass-roots network of municipalities, businesses and NGOs in Atlantic Canada in order to better understand the challenges and opportunities of sustainability and to move the region toward sustainable solutions. United by a common vision of a sustainable Atlantic Canada - and a common commitment to action - these organizations want to engage other communities, other businesses, and other levels of government to create a broad-based network that acts as a tipping point for greater sustainability in the region. Original partners included: Aliant, Antigonish Sustainable Development, Bathurst, HRM, Halifax Shambala Centre, iNova Credit Union, Jacques Whitford, Just Us! Coffee Roasters, P'Lovers, Saint John, Department of Natural Resources, Stratford, Wolfville. Other network partners included: Acadia University, AgriFood Canada, C-Ciarn Atlantic, Centre for Rural Sustainability, Ecology Action Centre, UNB, FCM, several Provincial departments, Memorial University, Nova Scotia Environmental Network, Public Works Canada, Rural Secretariat, St Margaret's Bay Stewardship Association, Cooperators Insurance, White Point Lodge.

ACSI catalyzed a lot of sustainability efforts in our region. After initial training and capacity building sessions, groups assembled for more focused efforts. HRM and the Province of Nova Scotia used the collaborative to work on a lot of our developing Green Procurement efforts and strategies which resulted in a breakout session on Green Procurement and two Green and Sustainable Procurement Webinars. The project helped birth the MASH sector Sustainable Procurement Network initiated by HRM staff and Provincial Procurement Staff in 2008 - which has continued as a collaborative effort to collectively work on sustainable procurement initiatives in a consistent and shared approach.

TNS Exchange
As a number of TNS organizations were applying the framework to practice, The Natural Step, upon request, created a Network Exchange for support and further learning. HRM is a member of the exchange (currently with approximately 40 members nationally). The exchange, initiated in 2009, hosts monthly Webinars and Telephone conferences to provide support. Examples of webinars included: a Presentation from Bob Willard, a presentation (jointly performed by HRM) on Green Procurement, Presentation from Bryan Smith on Sustainability Leadership, Presentation from Nike, Municipal Practitioners learning circle, and on Communication. Through this exchange, we are learning how best practice is evolving with application of Sustainability Filters.

The Natural Step is a tool in our building toolbox of sustainability solutions. It is not an exclusive framework, but has been found to be a good building block / foundation for staff as we catalyze sustainability actions corporately and in the community.

Online The Natural Step training is available to members of Regional Council. Licenses for the on-line training can be arranged through the SEMO office.

The systems thinking framework of The Natural Step compliments the approach that HRM has taken to environmental strategy. With the work done to generate the Regional Plan and many of the functional plans, which included Visioning, Backcasting, etc., adopting this framework helps consistently incorporate sustainability with our corporate activities.

BUDGET IMPLICATIONS

There are no specific budget implications related to this report. Funding for the Corporate Sustainability Analysis, Corporate Sustainability Training, and development of the Sustainability Filter have been provided by the Sustainable Communities Reserve (Q127) funded project Whole Systems Methodology CII00740.

FINANCIAL MANAGEMENT POLICIES/BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Capital and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Capital and Operating reserves, as well as any relevant legislation.

ATTACHMENTS

- 2004 Corporate Sustainability Analysis: http://www.halifax.ca/environment/documents/SustainabilityAnalysisSeptember2004.pdf
- Draft Sustainability Filter

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.

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Sustainability Analysis
using
The Natural Step Framework

for

Halifax Regional Municipality

Submitted on September 23, 2004

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Executive Summary

Halifax Regional Municipality (HRM) has identified a "healthy, vibrant, sustainable community" as one of its four main themes as part of its corporate scorecard. This represents an acknowledgement and expression of the fundamental importance that the residents of Halifax give to preserving and further developing some of its most unique attributes, including its cultural heritage and its natural environment. Implicit in this corporate theme is the need for an understanding of what a "healthy, vibrant and sustainable" community looks like. HRM's corporate scorecard specifies a number of outcomes and indicators, beginning from the perspective of the citizens of Halifax. From the perspective of the people who live and work in Halifax, a "healthy, vibrant and sustainable" community includes the preservation of the environment – the quality of the air they breathe, the water they consume, the land they live, work and play on.

To support the realization of this theme, HRM wants to demonstrate leadership by assessing and continuously improving its *own contribution* to the health, vibrancy and sustainability of the community. To do so, it must look at its own operations and programs to assess how they affect these indicators. This requires looking upstream – at the basic ways in which the HRM's internal processes contribute to degradation of the quality of the land, air, water, and community that is important to its citizens.

The Natural Step Framework provides a science-based definition of sustainability and a lens through which to look at the key components of a healthy, vibrant, sustainable community. It helps organizations develop strategies and prioritize actions by introducing science-based principles of sustainability as constraints within which solutions can be brought forward. It does so by identifying the basic mechanisms through which human societies disrupt social and natural systems and translating these into "*System Conditions for a Sustainable Society*". In other words, it helps organizations to understand the consequences of their choices on social and ecological systems upstream, in the planning stage, rather than after negative impacts have occurred, when it is often too late to do something about them.

The Sustainability Analysis provides a high level overview of the major ways that HRM contributes to violations of the four *System Conditions for a Sustainable Society*, points out how its many existing "green" initiatives are helping to reduce these contributions, identifies gaps and suggests some initiatives for further improvement. The focus for the Sustainability Analysis was on the departments that fall under the "Healthy, Vibrant and Sustainable Community" theme of the Corporate Scorecard. Over 25 managers and staff from 13 departments or functional areas were consulted to gather data.

The Sustainability Analysis revealed that HRM faces many challenges in becoming a healthy and sustainable community, specifically in regards to the use of energy and land, and the management of materials both within the organization (e.g. procurement) and in the community (e.g. solid waste management). However, the Sustainability Analysis also reveals what many in the HRM would probably have said from the outset – that there are numerous great initiatives and many good stories to tell about HRM efforts to achieve a healthy and more sustainable community. In fact, the HRM, its residents and businesses

have demonstrated leadership within the community, nationally, and internationally in terms of support for environmental and cultural initiatives in the past. These initiatives include the solid waste management program, the Halifax Regional Water Commission's watershed management plan, the pesticide by-law, the Climate Smart Program, and the Sustainable Community Reserve, the Pollution Prevention Program, and the new Regional Plan.

The analysis also revealed, however, that the **initiatives are, for the most part, quite scattered and only vaguely connected to each other and to an overall strategic plan for sustainability**. Furthermore, it revealed that while there are pockets of interest and capacity in sustainability within HRM, **there is a need to more thoroughly and effectively integrate sustainability into corporate culture**. A more strategic and holistic approach to sustainability would help ensure that the right initiatives are being prioritized and that investments are being properly leveraged. It would also help the HRM build internal capacity and communicate its initiatives internally and to the public, positioning them as part of an overall journey to a clearly defined destination: sustainability.

As a result, the recommendations arising from the consultation process with HRM staff can be divided into three broad categories: recommendations to enhance already **outstanding initiatives** with the TNS framework, recommendations relating to specific projects and **opportunities for improvement**, and recommendations for strengthening organizational capacity to move HRM towards sustainability by **building a philosophy of sustainability in corporate culture**. The recommendations are not presented as an exhaustive list and must be considered within the broader context of HRM's corporate strategy. Instead, they are an initial set of ideas to address some of the most significant gaps and to consider as part of the HRM's journey to a healthy, vibrant and sustainable community.

Recommendations to enhance existing strong programs or initiatives include:

1) Integrating the TNS framework into the Sustainable Community Reserve project review process.

2) Using the TNS framework as a guide for the Pollution Prevention Program

3) Reviewing the Regional Plan from a Strategic Sustainability Perspective.

Recommendations relating to opportunities for improvement include:

4) Developing a green building strategy

5) Integrating principles of sustainability in HRM procurement policies

6) Exploring opportunities to recycle electronics and light bulbs

7) Instituting an internal composting program

8) Evaluating the sustainability of different approaches to managing playing fields

9) Prioritizing bio-diesel produced from local, sustainably harvested feedstocks

Recommendations for building a philosophy in corporate culture include:

10) Integrating the TNS framework as a guide for the "Healthy, Vibrant and Sustainable" theme of HRM's Corporate Scorecard

11) Provide more opportunities for HRM staff to learn about sustainability

12) Creating a pilot project to explore how the TNS framework can be incorporated into environmental management systems.

Of these initiatives, there were two in particular that were noted in consultations by HRM staff as immediate and high leverage opportunities for improvement. The first was an initiative to incorporate sustainability thinking into *procurement* practices in order to demonstrate leadership in the area. Initially, this may consist of a pilot project to evaluate the way this can be done and increase organizational capacity on sustainability principles. The second was to develop a stronger *corporate culture* around sustainability in order to engage people in HRM offices to generate ideas for improvement. A strong corporate culture around sustainability lays the learning and growth foundation for improvements in operational practices.

1 Introduction

From April to August 2004, The Natural Step (TNS) Canada led a process of analyzing the operations of Halifax Regional Municipality (HRM) from a holistic sustainability perspective, using The Natural Step Framework. This report is the output of that process, referred to henceforth as a Sustainability Analysis.

The Sustainability Analysis was commissioned by the Environmental Management Services department of HRM to help determine where the HRM is currently at with respect to sustainability, and then to use this information to identify areas for improvement. The Sustainability Analysis uses a scientifically rigorous definition of sustainability as a benchmark to identify key broad trends and gaps, and also highlights specific examples of current and potential HRM initiatives to address some of the gaps.

The document is structured as follows: the main document briefly describes the context for the Sustainability Analysis and its connection with HRM's corporate scorecard, provides an overview of the process used to perform the analysis, and summarizes some of the key findings and recommendations. The appendices provide a summary of the TNS Framework and more detailed analyses of the various HRM departments, divisions and functional areas that were studied.

2 Why a Sustainability Analysis?

2.1 A Healthy, Vibrant, Sustainable Halifax

In its corporate scorecard, Halifax Regional Municipality (HRM) has identified a "healthy, vibrant, sustainable community" as one of its four main themes. This represents an acknowledgement and expression of the fundamental importance that the residents of Halifax give to preserving and further developing some of its most unique attributes, including its cultural heritage and its natural environment.

Implicit in this corporate theme is the need for an understanding of what a "healthy, vibrant and sustainable" community looks like. HRM's corporate scorecard specifies a number of outcomes and indicators, beginning from the perspective of the citizens of Halifax. From the perspective of the people who live and work in Halifax, a "healthy, vibrant and sustainable" community includes the preservation of the environment – the quality of the air they breathe, the water they consume, the land they live, work and play on. For this reason, HRM is currently developing a State of the Environment Report that will track and communicate various indicators relating to air quality, water quality, land-use, and energy use in the community.

While the State of the Environment Report will measure the outcomes (i.e. the quality of land, air, water, etc.), HRM also wants to demonstrate leadership by assessing and continuously improving its *own contribution* to the health, vibrancy and sustainability of the community. To do so, it has to look at its own operations and programs to assess how they affect these indicators. This requires looking upstream – at the basic ways in which the HRM's internal processes contribute to the quality of the land, air, water, and community that is important to its citizens.

2.2 The Natural Step – Linking Outcomes with Internal Processes

The TNS Framework provides a science-based definition of sustainability and a lens through which to look at the key components of a healthy, vibrant, sustainable community. It is tailor-made to help organizations identify the basic ways in which they are contributing to unsustainable and unhealthy communities, and determine strategies to reduce and eliminate their contributions[1]. The point of identifying these contributions is not to judge whether HRM is performing well or badly, but rather to have a holistic, rigorous understanding of its sustainability challenges to allow the HRM to effectively and creatively solve them.

The Natural Step defines sustainability on the principle level, as far upstream as is possible, by identifying the basic social and ecological mechanisms through which

[1] As the framework helps to demonstrate and articulate, there is a fundamental connection between health and sustainability. Vibrancy, though related to social sustainability, is less explicitly built into the TNS Framework. For this reason, the language of the Sustainability Analysis will focus more on health and sustainability.

human societies disrupt social and natural systems and translating these into "*System Conditions for a Sustainable Society*". In other words, it allows organizations to understand the consequences of their choices on social and ecological systems in the planning stage, rather than after negative impacts have occurred, when it is too late to do something about them. Organizations and communities can use the *System Conditions* to assess their own contributions and performance and to guide planning and decision-making.

In order to achieve sustainability, the challenge for HRM is to identify how it is contributing to these basic mechanisms, and then to reduce and ultimately eliminate those contributions in the most economically efficient way possible. This is what the TNS Framework is designed to help organizations do.

The Sustainability Analysis provides a high level overview of the major ways that HRM is contributing to violations of the four *System Conditions for a Sustainable Society*, points out how its many existing "green" initiatives are helping to reduce these contributions, and identifies some of the main areas for improvement and options to improve community sustainability and health.

A familiarity with the main concepts of the TNS Framework is fundamental to understanding the observations and recommendations of the Sustainability Analysis. The next section provides a brief introduction to the *System Conditions for a Sustainable Society*. More detailed information on these and The Natural Step Framework as a whole can be found in Appendix I.

2.3 System Conditions for a Sustainable Society[2]

The earth is a sustainable system. Natural cycles have been running on the planet for millions of years and have resulted in the vast diversity and abundance of life today. However, scientists agree that human society is damaging these natural cycles and altering life-supporting ecological services in three basic ways. Based on this scientific understanding, The Natural Step has defined three basic system conditions for maintaining essential ecological processes. In addition, The Natural Step recognizes that social and economic dynamics fundamentally drive the actions that lead to ecosystem changes. Therefore, the fourth system condition focuses on socio-economic dynamics and affirms that meeting human needs worldwide is an integral and essential part of sustainability. The system conditions for a sustainable society are:

[2] If the reader is familiar with the system conditions, please feel free to move past this section onto the next. This section is meant as a brief introduction to the language and science of the system conditions, because they will be referred to elsewhere in the document.

In a sustainable society, nature is not subject to systematically increasing:

- **…concentrations of substances from the earth's crust (SC1),**
- **…concentrations of substances produced by society (SC2),**
- **…degradation of nature by physical means (SC3),**

and in that society people are not subject to conditions that systematically

- **…undermine their capacity to meet their needs (SC4).**

When reading the system conditions, it is important to note that the concern is with "*systematic increases*". For example, some people assume that SC1 implies that in a sustainable society we should not use metals or minerals. This is an incorrect interpretation of SC1. A correct interpretation recognizes that the concern is with systematic increases in concentrations of metals. In an unsustainable society, metals are used in such a way that they are bound to systematically increase in concentration in natural systems, which then leads to negative downstream effects, many of which we are more familiar with. For example, mercury is a concern to human and ecological health because it is relatively scarce in nature and therefore societal flows of mercury can lead to a rapid increase in concentration until it eventually becomes toxic. If we are dependent on systems that increase the concentration of mercury in natural systems (e.g. coal-fired power plants, disposal of mercury rich electronic devices in landfills, etc.), then we will see a systematic increase and the related negative downstream effects (e.g. mercury in fish, and then in humans).

The same thinking applies with SC2, where the concern is the systematic increase of substances produced by society. For example, society produces upwards of 80,000 chemicals, many of which are foreign to nature. Nature therefore does not have the ecological processes by which to break them down quickly. As a result, these chemicals systematically increase in concentration and move closer to their toxic thresholds, since toxicity is simply a function of concentration (i.e. even water is toxic at a certain concentration). A violation of this basic mechanism (e.g. increases in PCBs, DDTs, brominated fire retardants) has resulted in numerous negative downstream human and ecological effects.

2.4 Process of the Sustainability Analysis

The process of performing the Sustainability Analysis involved a series of consultations with representatives from a wide range of HRM departments, divisions, and functional areas. TNS Canada worked with Stephen King (Manager and Senior Advisor, Strategic and Sustainable Resource Management, Environmental Management Services) to identify the corporate departments and functions that would be analyzed.

The project scope did not allow for consultations with every HRM department. Therefore, the main areas of focus for the Sustainability Analysis were those departments that fall directly under the "Healthy, Sustainable, Vibrant Communities" theme of the HRM Scorecard, as described in the 2003 HRM Annual Report. These include

Environmental Management Services, Planning and Development Services, Public Works and Transportation, Real Property and Asset Management, and Recreation, Tourism and Culture.

Over 25 managers and staff from 13 departments or functional areas were consulted to gather data. First, the HRM staff people attended a half-day introductory workshop on the TNS Framework, which was conducted to familiarize them with the language of sustainability and the process that would be used for the Sustainability Analysis. Two such workshops occurred.

Then, individual consultations were held with the representatives of the following functional areas:

- Real Properties and Asset Management
    - Capital Projects
    - Maintenance
    - Fleet Management
    - Parks and Open Spaces
- Recreation, Tourism and Culture
- Metro Transit
- Public Works and Transportation
    - Transportation Management
- Regional Planning
- Environmental Management Services
    - Solid Waste
    - Wastewater
    - Climate Smart
    - Pollution Prevention (Air, Land & Water)
- Halifax Regional Water Commission
- Financial Services
    - Procurement

The first consultations identified the main inputs, outputs and waste streams of the department in question, including energy, material, land, transportation, contract service inputs, product and service outputs, and waste, emissions, and by-products. The scope of the analysis was mainly on critical flows (qualitative), rather than on detailed (quantitative) data, however in some cases where possible, data was gathered, both regarding the material and the relative budget. Finally, the consultations identified existing HRM programs that have a positive impact on social or environmental sustainability.

TNS Canada took this data and analyzed it through the lens of the TNS Framework, translating the information into an assessment of the current performance of the

department against the four system conditions for a sustainable society, describing transition guidelines to achieve sustainability, and positioning existing programs accordingly.

Draft reports for each section were submitted to the various functional areas and department representatives, and then follow up consultations were organized to make revisions. As a final step, TNS Canada then produced this report.

3 Overview of Sustainability Challenges

This section provides an overview of the main challenges for HRM in order to come in alignment with the four System Conditions for a Sustainable Society. It represents a synthesis of the consultations with HRM staff, and the findings are further elaborated upon in the appendices. The challenges are grouped into the common municipal topics of energy, materials, land, transportation, water, and social sustainability, while the connections with the System Conditions are described within each challenge.

3.1 Energy

Some of the most significant sustainability challenges facing HRM relate to its use of energy. In 2003, HRM spent approximately $7 to $8 million on energy. This is roughly divided between 1/3 for oil (space heating) and 2/3 for electricity. In addition, a small amount of propane is purchased. Approximately 90% of the electricity generated in Nova Scotia is through the combustion of fossil fuels, mainly in the form of coal and oil. As a result of the fossil-fuel intensive energy mix, the consumption of electricity leads to increases of many substances such as carbon dioxide (SC1), sulfur dioxide (SC1), mercury (SC1), nitrous oxides (SC2), volatile organic compounds (SC2), and others. For example, HRM buildings cause an estimated 60,000 tonnes of CO_2 equivalents in greenhouse gas emissions.

An increase in concentration of the above substances in a community also causes negative health effects (e.g. asthma) that may provide a barrier to people's ability to meet their basic human needs (SC4), because it may affect their lifestyles and even their ability to support themselves. A recent study by *Genuine Progress Indicator Atlantic* (GPI Atlantic) states that Nova Scotia emits more SOx from electric power generation by utilities than any other Canadian province (135kt), leading to high costs associated with human health and other environmental damage. [3]

Please note that the sustainability concern is not the use of energy per se, but rather the systematically increasing concentration of substances in nature and consequent negative effects on human, community and ecological health (e.g. poor air quality, acid rain, climate change, mercury in fish, etc.). Even without exact data about the size of this flow that is created by HRM, as long as HRM continues to be dependent on forms of energy derived from fossil fuels, it is possible to draw the conclusion that these increases will continue.[4]

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[3] For more information please refer to a report titled "The Ambient Air Quality Accounts for the Nova Scotia Genuine Progress Index", which can be found in the GPI Atlantic website at www.gpiatlantic.org.

[4] Please note that the use of fossil fuels also results in a number of *indirect* impacts resulting from the production of fossil fuels. These include systematic physical disruption of land through exploration and extraction (i.e. drilling and mining) (SC3), the release of trace metals through mining (SC1), and the release of persistent chemical compounds when refining fossil fuels (SC2).

Finally, it is also important to consider the opportunities to improve energy efficiency and thereby save costs. By improving energy efficiency in a cost-effective manner, HRM can ensure that its resources are not spent wastefully on extra energy but rather on programs that better serve its citizens (SC4). HRM is currently evaluating options to use energy more efficiently on a community level. For example, in August 2004, HRM hosted an Energy and Environment Roundtable to discuss opportunities for costs savings and greenhouse gas emissions reductions through the implementation of a district energy system.

3.2 Materials

Materials include all the tangible products used by HRM and its citizens. These include both durable products such as computers, vehicles and building materials, and consumable products such as cleaners, paints, and paper. The way in which HRM manages materials is important to community health and sustainability. This section is divided into two parts: one that discusses materials management at the community level and another at the corporate level.

3.2.1 Community Materials Management

In 2003, HRM collected over 111, 500 tonnes of materials from households, in addition to receiving 90,000 tonnes from businesses and special events. The most common way of managing these materials in Canadian municipalities is by depositing them in landfills. Using landfills as a form of material management creates less sustainable and less healthy communities by physically encroaching into natural areas (SC3), concentrating *scarce metals* that may eventually leak into nature (SC1), transforming organic materials into *methane gas* (SC2), concentrating *chemical compounds* (SC2) that may eventually leak into nature, creating a potential *human health hazard* (SC4)[5], and *wasting valuable resources* that could be used to fund programs to deliver services to citizens (SC4)[6].

At the community level, HRM is a Canadian leader in providing services that improve the management of materials. Its system includes programs to manage:

- …scarce metals - through HRM's programs to recycle *aluminum cans*[7] and *batteries (*cadmium, nickel, etc.).

[5] For example, the Sackville landfill did not initially have any leachate treatment facilities for its first 10 years of operation, and 35 households had to be moved resulting in $10 million dollars of compensation paid out by HRM. In addition to health issues, other citizen concerns with landfills near their homes deal with pests, noise, and smells (SC4).

[6] Due to the efforts of HRM, upwards of 55% of materials traditionally considered waste from households is now diverted from landfill, decreasing HRM's need to build new landfill infrastructure. As a result HRM is saving $15 million in capital costs every three years, in addition to generating revenue through the sale of recyclables, which also generates revenue.

[7] In 2003, 16,500 tonnes of recyclables – metals, plastics, and glass – were diverted from landfill.

- …organic materials - through HRM's excellent composting program that diverts from landfills 29,000 tonnes per year of organic material from households and 13, 000 tonnes per year from businesses and special events.

- …chemical compounds - through HRM's program to capture CFCs, oils (many additives), tires (many additives), and recycle plastics (plasticizers and other additives),

However, this is not to say that there is no room for improvement. For example, HRM lacks programs to recycle metals found in common products such as *light bulbs* (mercury) and *consumer electronics (*mercury, copper, lead, etc.*)*. In addition, many other similar compounds pose a threat to community health. Currently there are almost 80,000 man-made chemical compounds, many of which are used in products found in households and businesses. For example, many household products, from furniture to electronics, contain *brominated-fire retardants,* a known carcinogen. Society currently does not have enough resources to determine the exact toxicity of each compound. However, if products are continuously disposed of in landfills, these compounds will systematically increase in concentration and, at some point in time, will hit their toxicity thresholds.

The sustainability challenges associated with solid waste management are described in more detail in the appendix titled Solid Waste.

3.2.2 Corporate Materials Management

In consultations with many HRM departments and functional areas, *the incorporation of sustainability principles into procurement practices was considered a priority area for improvement*. The associated sustainability challenges are summarized below and described in more detail in the appendix titled "Procurement".

HRM is a significant consumer of materials, with an estimated $100 million worth of purchases from the procurement department alone. This figure does not include the materials purchased through contractors and used in capital projects and maintenance operations. Within HRM, there are currently no formal policies or programs to incorporate sustainability principles into purchasing or contracting. In other words, there are no formal programs to ensure HRM is not using products that:

- … are energy inefficient and/or contain scarce metals that are not recycled(SC1)

- …contain persistent chemical compounds that pose a threat to human health and its ecological resources (SC2)

- …are from companies using land management practices that physically harm life-sustaining systems(SC3)

- … are produced using manufacturing processes that interfere with others' ability to meet their need (SC4)

Furthermore, despite its leading-edge community organics composting system and a major program for yard waste, HRM does not currently have an internal organic composting program for its offices. While the sustainability impacts of disposing of organic materials in the regular waste stream may not be among the most serious facing the HRM at a corporate level, *there is a public relations risk associated with promoting the benefits of organic composting to citizens while not practicing it internally.*

3.3 Land

Recent growth patterns in the HRM point to a significant sustainability challenge associated with development. For a more elaborate discussion of the sustainability challenges related to land use practices please refer to the appendix titled "Land Use and Transportation". The following is a snapshot of the main sustainability challenges.

Current development practices reinforce the systematic degradation of nature by physical means, such as removing forests, draining wetlands, fragmenting wildlife habitat, and paving over natural areas to build new subdivisions and new transportation infrastructure (SC3). From 1996 to 2001, the population of HRM grew almost 5%, or at a consistent increase of about one percent per year. The growth rate over the next 25 years is expected continue by one percent per year. At this rate of growth, the population of HRM by 2038 is expected to increase by 75,000 to 100,000 to almost half a million residents. In addition, the consumption of land per person has quadrupled since the 1960s. At current rates of land consumption, approximately 50,000 more acres would be required for residential land. A development strategy is sustainable only if it does not reinforce the need for ever-increasing consumption and modification of natural areas. HRM has recognized the need for such a strategy and the seriousness of the sustainability challenges associated with recent development patterns by initiating a regional planning process that is elaborated upon in the Land Use and Transportation appendix.

3.4 Transportation

Many of the most serious sustainability challenges facing HRM relate to transportation, which is closely related to land-use patterns. For a more elaborate discussion on the sustainability challenges of transportation, please refer to the appendix titled "Land Use and Transportation" and "Fleet Services". The following is a snapshot of the main sustainability challenges.

According to HRM's Regional Planning group, if current growth patterns continue, another 70,000 vehicles are expected to be on the road by 2028, contributing an extra 45,000 tonnes of greenhouse gases each year (SC1). Since private vehicles are run on fossil fuels, a reduction in private vehicle use will reduce the accumulation of carbon dioxide (SC1), sulphur oxides (SC1), nitrous oxides (SC2), particulate matter (SC1), volatile organic compounds, and other substances. Increases of these substances contribute to an unsustainable and unhealthy community by worsening urban air quality, accelerating climate change, and promoting acid rain.

Currently, most residents in HRM use a private vehicle to commute to work (68% - less than the national average of 71%). In addition, 86% of people who live in rural areas drive to work, primarily because public transit is not readily available. This is a strategic concern because the fastest growth in development is in rural areas, with the population in rural areas expected to grow by 50% over the next 25 years. As a result, even more private vehicles will on HRM roads if transit services are not improved. Currently, 10% of HRM residents take public transit to work and only 1% of residents commute by bicycle.

Another area where HRM is dependent on transportation is with respect to *procurement of products,* especially if products are transported over large distances from the manufacturer to HRM. For example, it was estimated that 80% of building materials used in HRM buildings are transported from outside of the Halifax region.

3.5 Water

The main sustainability challenge associated with water in the HRM is the discharge of over 181 million litres per day of untreated water, both sanitary and storm wastewater, into the Halifax Harbour. Since the harbour is one of the best deepwater, ice-free ports in the world and a major part of economic activity and community life in the HRM, wastewater management is very high on the public and political agenda. As described in the appendix titled Waste Water, this practice has numerous associated sustainability impacts, including the negative effects of excessive amounts of organic material on marine life (SC 3), and the release of trace amounts of scarce metals (SC 1), excessive nutrients (SC 1), and persistent chemical compounds such as pesticides and pharmaceuticals (SC 2), and other garbage. It also has the added negative effects of restricting alternative uses of the harbour (SC 4), such as for recreation and tourism, and of hurting Halifax's image in a general sense, which can carry economic impacts (SC 4) for the region on top of the environmental impacts. Section 4.1.5 describes the Harbour Solutions Project, which aims to address the significant sustainability challenges described above.

The HRM has a very progressive approach to protecting its potable water supply, as described in section 4.1.2. However, one additional water-related sustainability challenge is the large number of private septic systems within the HRM. HRM cannot easily ensure the safety and proper functioning of so many private systems, which means that the risk of contamination is increased (SC4).

3.6 Social Sustainability

Social sustainability is equally as important to a healthy, sustainable, vibrant Halifax as ecological sustainability, and the two cannot be considered independent of each other. However, social sustainability often presents considerable difficulty from a practical standpoint.

The Natural Step Framework approaches social sustainability similarly to how it approaches ecological sustainability – by defining success on a principle level and using that principled understanding of success to begin taking step by step moves today to move forward. Social sustainability is defined as the elimination of barriers that

undermine people's ability to meet their basic human needs.[8] For example, working or living conditions that cause people to become sick would constitute a health and environmental barrier to people's ability to meet their basic human needs. Likewise, if HRM purchased goods from countries where people are not allowed to self-organize into unions, this would constitute a political barrier to people meeting their needs. The challenge, as with ecological sustainability, is to identify all such barriers that HRM contributes to and to systematically reduce and eliminate HRM's contribution to them over time in the most economically efficient manner possible, acknowledging the fact that only certain activities are within the sphere of influence of HRM.

There are many ways in which HRM makes a positive contribution to social sustainability by providing services that help people to meet their needs, for example through clean water, the elimination of harmful pollutants, and the many activities offered through its recreational and cultural programs. HRM should be commended on making these, and many other services, accessible to all residents. In addition, HRM provides a safe working environment for employees and fair wages. However, the following areas have been identified as potential areas where barriers are placed on people's ability to meet their needs.

- Two main features of our *land use practices* over the past several decades have converged to generate haphazard, inefficient, and unsustainable development sprawl – zoning regulations that separate housing, jobs, and shopping, and low density development that requires the use of the car.[9] This leads to many social sustainability challenges for HRM, including the increased amounts of time wasted in traffic (SC4), inefficient use of public funds to extend municipal infrastructure and services (SC4), an inactive daily lifestyle contributing to the emerging obesity crisis (SC 4), and hindering social interaction and community participation that builds community and encourages a sense of neighborhood (SC4).

- A lack of access to *affordable housing* is a condition that undermines people's ability to meet their needs both through limited access to shelter and through limited financial resources to pay for other items, such as food. In 2001, 44% of rental households in Halifax paid more that 30% of their income on shelter, one of the highest percentages in the country. While this statistic is influenced by a relatively high level of university students in Halifax renting apartments (i.e. students spend a high level of their income on housing), it remains an important social sustainability

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[8] One of the most well known definitions of needs is by the Chilean economist Manfred Max-Neef: subsistence, protection, participation, idleness, creation, affection, understanding, identity, and freedom.

TNS has chosen to use the Max-Neef analysis for the purposes of this discussion for two reasons. First they encompass the most basic of needs, still a priority in too many parts of the world, as well as human needs beyond the basics of physical survival which are pertinent to us all. Secondly they give a deeper foundation, and set the context for, other descriptions such as the Universal Declaration of Human Rights.

[9] American Planning Association. (2002). Policy on Planning for Sustainability. http://www.planning.org/policyguides/sustainability.htm

challenge. A major effort to expand affordable housing is already underway, involving other levels of government.

- *A lack of formal policies to ensure that procurement of products* from companies and countries that do not create barriers to people meeting their needs. These barriers can be economic (e.g. providing low wages), health and safety related (e.g. unsafe working conditions), and political (e.g. not allowing people to self-organize). A simple example of this is coffee procured from farmers that are not given fair wages (SC4), nor allowed to form into strong unions (SC4).

4 Recommendations

The Sustainability Analysis revealed what many in the HRM would probably have said from the outset – that there are numerous great initiatives and many good stories to tell about HRM efforts to achieve a healthy and more sustainable community. In fact, the HRM, its residents and businesses have demonstrated leadership within the community, nationally, and internationally in terms of support for environmental and cultural initiatives in the past.

The analysis also revealed, however, that the **initiatives are, for the most part, quite scattered and only vaguely connected to each other and to an overall strategic plan for sustainability**. Furthermore, it revealed that while there are pockets of interest and capacity in sustainability within HRM, **there is a need to more thoroughly and effectively integrate sustainability into corporate culture**. A more strategic and holistic approach to sustainability would help ensure that the right initiatives are being prioritized and that investments are being properly leveraged. It would also help the HRM build internal capacity and communicate its initiatives internally and to the public, positioning them as part of an overall journey to a clearly defined destination: sustainability.

In this light, a Sustainability Analysis using the TNS Framework was an extremely relevant first step, since it helps to bring all the initiatives together in the context of a scientifically-based definition of sustainability, to position them in terms of how specifically they are helping make the community more sustainable, and also to identify gaps and areas for improvement.

This section is therefore structured to summarize initiatives in this sense. First, it highlights some **outstanding existing HRM initiatives** and briefly describes how they contribute to bringing the community closer to sustainability. Secondly, it points out some **opportunities for improvement**. This includes specific recommendations for initiatives to address sustainability gaps and move the community even closer to sustainability. Finally, the analysis provides recommendations for **integrating sustainability into corporate culture at HRM.**

4.1 Outstanding HRM initiatives

As mentioned, there are numerous examples of outstanding HRM initiatives that are significant, positive steps on the journey to sustainability. In this section, we highlight HRM initiatives that are excellent examples of preventative, upstream approaches to sustainability and, in this sense, illustrative of the main concepts of the TNS Framework. Recognizing that these initiatives have received many accolades from a variety of sources, we will not describe the initiatives in detail here but rather point out, from the perspective of the TNS Framework, ***how*** specifically they contribute to moving the HRM closer to sustainability. In some cases, we also provide recommendations to ensure that the potential of these initiatives to contribute to a more sustainable community are fully realized by consciously integrating a strategic sustainability perspective.

4.1.1 Solid Waste

The HRM's much admired solid waste management system (analyzed in detail in the appendix titled Solid Waste) acts as a catalyst to allow households and organizations in the HRM to manage materials in a more sustainable manner. The system allows many materials to be kept in either a *technical cycle*, in the case of batteries and paints, or in a *natural cycle* in the case of organic materials. Managing materials within these cycles prevents them from becoming waste, lessening the contribution of the HRM to systematic build-up of metals (SC 1) and persistent compounds (SC 2) and the release of methane from the decomposition of organic material (SC 2). Every year since 1999, 50% to 55% of household materials has been diverted from landfill, with a target of 60% in 2004. This means that the system also lessens the extent to which the HRM depends on an ever-expanding requirement for land (SC 3) to manage its waste.

It is important to note that despite the impressive contribution of the solid waste system to making the HRM more sustainable, to the extent it does not achieve a 100% closed-loop system for materials management, sustainability challenges remain. In addition, some critical or symbolic waste streams should be diverted from the landfill sooner rather than later. For example, the recycling of electronics and light bulbs and the composting of organic waste within HRM offices are explored in section 4.2. Overall, the solid waste system goes a long ways to helping the HRM achieve sustainability and is a platform for future improvements in both material quantity and quality.

4.1.2 Watershed Management Plan

The Halifax Regional Water Commission has an aggressive watershed management plan (described in more detail in the appendix titled Water Supply) that involves purchasing and protecting as much as land as possible in the watersheds of Lake Major and Pockwock Lake, as well as consulting with numerous stakeholders through active watershed advisory committees. This approach to water management has numerous sustainability benefits. First, the protection of the land limits the potential for physical encroachment into natural areas for development (SC 3). Furthermore, protecting water at the source rather than relying heavily on treating the water to improve its quality lessens the systematic accumulation of substances (SC 1, 2) through the treatment process. It is another excellent example of a preventative, upstream approach to sustainability.

4.1.3 Pesticide By-law

The HRM was the first major city in Canada to pass a by-law regulating the use of chemical pesticides on residential and municipal properties. By restricting the use of chemical pesticides, the HRM has made a tangible, proactive step to reduce the systematic build-up of persistent compounds (SC 2) in nature and the downstream human health effects (SC 4) of some of those substances. The Pesticide by-law (described in more detail in the appendix titled Parks and Open Spaces) is an excellent example of a preventative, upstream approach to sustainability.

4.1.4 Climate Smart Program

The HRM's Climate Smart Program is noteworthy as an outstanding initiative in that it focuses on both mitigating the greenhouse gas emissions that cause climate change *and adaptation* to the predicted effects of climate change. As a coastal city that has experienced more than its fair share of weather-related disasters in recent years, the HRM has recognized that the risks associated with climate change are serious and real. More than simply reducing its emissions (a laudable goal itself from a sustainability perspective and explored in more detail in other recommendations), the HRM has committed to managing the social and economic risks (SC 4) associated with climate change by investing in adaptation strategies in planning and infrastructure (analyzed in more detail in the appendix titled Land Use and Transportation). Doing so is a preventative approach to major potential disruptions from climate change, such as rises in sea level and severe weather events, which would create barriers to people meeting their needs (SC4).

4.1.5 Sustainable Community Reserve

For the reasons described in section 3.5, the HRM's Harbour Solutions Project, designed to eliminate the flow of raw sewage and other contaminants into the Halifax Harbour through construction of three new advanced primary treatment plants and completion of the Halifax Harbour collection systems, is an important initiative for reducing the sustainability impacts of the HRM. The $333 million capital budget for the project also points to the costly implications of having to deal with sustainability problems downstream.

Although it is a downstream solution that does not entirely address the related sustainability impacts, the Harbour Solutions Project has been innovatively designed in such a way that it can serve as a stepping stone for future HRM moves toward sustainability, both technically and financially. For example, the **Sustainable Community Reserve** that will be set up as a result of the innovative financing mechanism generated through the Federation of Canadian Municipalities $20 million preferred-interest loan for the Harbour Solutions Project will give the HRM a fund to finance new "green" initiatives in the community. It is expected to generate $3 million to $4 million over 10 years, plus allow the HRM to leverage other funding. This is an inspired, innovative way to ensure that the legacy of the Harbour Solutions Project goes beyond cleaning up the harbour to promote creative new initiatives for a more sustainable community.

Recommendation #1: Integrate the TNS Framework into the Sustainable Community Reserve Project Review and Selection Process

The criteria for project consideration for funding from the Sustainable Community Reserve are already in place and are based on the Federation of Canadian Municipality's guidelines, thus taking key elements of the TNS Framework into consideration. Explicitly incorporating the TNS Framework into project review and selection process would help ensure that investments from the Reserve are guided by a scientifically rigorous understanding of sustainability and a strategic approach for determining priorities. It would also help build knowledge about the TNS Framework and skills in applying it within HRM staff.

4.1.6 Pollution Prevention Program

In addition to treating the wastewater to ensure that contaminants do not enter the harbour, the contaminants can be stopped from entering the wastewater in the first place. The HRM's source control strategy, now referred to as the Pollution Prevention (P2) Program aims to reduce the levels of nutrients (SC 3), metals (SC 1) and toxins (SC 2) currently entering the wastewater system and, ultimately, the Halifax Harbour. The Wastewater Discharge By-Law (W-101) regulates the discharge of specified substances and concentrations, such as paints, solvents and other hazardous, metal-rich and toxic products and wastes. The Pollution Prevention (P2) Program enforces compliance with the Wastewater Discharge By-Law through planning, education, inspections, and monitoring at the source of these discharges. This is an excellent example of an upstream approach to sustainability and yields great promise for expansion.

A focus on the most hazardous and toxic substances is an important first step and ensures that the HRM is in compliance with regulation and in line with other municipalities. Ultimately, however, full sustainability would require that no metals, nutrients or persistent compounds are released in a way that allows them to accumulate in nature. The Pollution Prevention Program is a good platform from which to continuously move forward toward that goal.

Recommendation #2: Use the TNS Framework as a Guide for the Pollution Prevention Program

Using the TNS Framework as a guide for P2 program design and related education and communication materials could help a) ensure that the program is guided by an ultimate vision of sustainability toward which continuous improvement efforts can be directed and b) communicate the importance of the program for the HRM's efforts to become a sustainable community.

4.1.7 Regional Plan

As described in sections 3.3 through 3.6, the way a community is designed is one of the most significant contributors to its sustainability. Beyond the obvious impacts of urban sprawl on the physical degradation of nature through a systematic encroachment into natural areas for development , it also contributes to a range of other sustainability challenges including the release into the atmosphere of greenhouse gases and other

pollutants through excessive reliance on private automobile-based transportation, the downstream human health impacts of these pollutants and of an automobile-based lifestyle, and the limitations that expanding capital infrastructure requirements place on public finances.

The Regional Plan that the HRM is currently developing (analyzed in detail in the appendix titled Land Use and Transportation) recognizes these sustainability challenges and makes the protection of open spaces and the enhancement of the role and scope of public transit important foundations for the plan. Furthermore, the Regional Plan is being developed through open consultation with the citizens of the HRM, giving residents the opportunity to participate in the plan that will guide development in their community over the next 25 years. If this development occurs with sustainability in mind, as the Regional Plan promises to ensure, there may be no more important initiative for the HRM's journey to sustainability. Intervening in a system at the design stage is one of the highest leverage ways to ensure a holistic, upstream approach to sustainability.

Recommendation #3: Review a draft Regional Plan from a Strategic Sustainability Perspective

When it reaches a draft stage, the HRM should undertake a review of the Regional Plan to ensure that the principles of sustainability have been effectively integrated into the plan. The Natural Step has developed an analytical tool to better understand how and if principles of sustainability have been incorporated into community sustainability plans. It could be useful in reviewing the HRM's Regional Plan from a strategic sustainability perspective. Currently this tool is being used in conjunction with the Resort Municipality of Whistler to evaluate how well principles of sustainability have been incorporated into their Comprehensive Sustainability Plan, the plan that will guide the development of Whistler for the next 25 years.

4.2 Opportunities for Improvement

Although the Sustainability Analysis highlighted many positive initiatives of the HRM, it is also clear from the findings described in section 3 that the HRM, like most communities and organizations, is far from being sustainable. It is a long and difficult journey to sustainability, and this underscores the importance of being strategic in our approach. Being strategic implies a) having a clear sense of where we are headed and b) selecting and implementing improvement measures that address important challenges.

The Sustainability Analysis also revealed a number of opportunities for improving HRM's sustainability performance. The recommended initiatives below are not an exhaustive list that will allow HRM to achieve full sustainability if implemented, but are put forward for consideration either because they help address particular gaps identified by the Sustainability Analysis, because they ensure a sustainable direction for future initiatives, or because they show great promise for building on existing programs and strengths. They should be considered among a suite of many initiatives.

4.2.1 Green Buildings

HRM's building stock of more than 300 buildings presents one of its most significant improvement opportunities with respect to its sustainability challenges. While they affect all of the challenges covered in section 3, improvements in the building stock could most directly affect the sustainability challenges associated with energy and materials. As described in section 3.1, one of the most significant sustainability challenges facing the HRM is its dependence on fossil fuel-based energy, which causes a number of social and environmental impacts, but also introduces a significant economic risk. Buildings are responsible for a significant amount of HRM's total energy use and greenhouse gas emissions. The construction, maintenance and renovation of buildings are also activities that use significant amounts of materials and generate considerable material waste. Two existing initiatives are noteworthy in this respect:

- ***Energy efficiency pilot projects***

  The HRM's Climate Smart Program introduces a number of measures to reduce greenhouse gas emissions to an established target of a 20% reduction as a participant in the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program. Of the many worthwhile initiatives outlined in the plan, we feel that the recent hiring of an energy efficiency expert in RPAM to review opportunities to reduce energy in HRM buildings is among the most important and promising. Currently, two pilot projects are being conducted to test different approaches to achieving energy savings in HRM buildings. One involves hiring an energy savings company (ESCO) to implement energy efficiency improvements on the garage for transit vehicles, which is the largest single consumer of energy in the HRM building stock. The second involves HRM itself making renovations on a 25,000 sq ft. library, including the installation of light tubes, new pumps and high-efficiency motors. The expected outcome of both projects to generate enough future cash flow to support future investments to further reduce carbon emissions.

- ***Building materials recycling***

  While no formal policy or program exists to purchase and/or manage building materials in a more sustainable manner, RPAM has an informal system for recycling some building materials. Considerable opportunity exists to formalize some of this expertise and also to intervene in the design stage to affect the types of building materials purchased and the ways that they are managed.

The HRM stands to benefit tremendously from the lessons gained in these pilot projects and informal systems. The reduction in greenhouse gases associated with energy savings will reduce one of HRM's most significant sustainability challenges. Purchasing and managing building materials more sustainably could have a broader impact on HRM purchasing policies (see section 4.2.2). Equally as significant, the energy savings will reduce operating costs and shield HRM from the risk of likely increases in energy prices

over the long-term. Efficiency improvements are generally good early move moves for these reasons, and because they can be built upon for future improvements. The energy efficiency investments should, however, be undertaken with a full sustainability perspective in mind, since a narrow focus on greenhouse gas emissions reductions can result in investments that introduce new sustainability challenges while reducing emissions. For example, higher efficiency compact fluorescent light bulbs (CFLs) contain a higher level of mercury that incandescent light bulbs. Since mercury is harmful to human health at low concentrations, the improper management of CFLs may result in a large flow of mercury to landfill or incineration and unintended negative consequences. **A broad green building strategy would help HRM build the necessary capacity and interdepartmental connections to fully realize the benefits of a holistic and integrated approach.**

Recommendation #4: Develop Green Building Strategy

The HRM should:

a) Ensure that the lessons from the 2 pilot energy efficiency projects described above are used to inform an expansion of HRM's energy efficiency efforts into a Green Building Strategy;

b) Increase the capacity of HRM staff to support the development and implementation of the Green Building Strategy by developing and/or obtaining the relevant skills;

c) Commit further financial resources to a wider program of capital improvements to support the Green Building Strategy; and

d) Ensure that the TNS Framework is used in the development of the Green Building Strategy and to assess related initiatives, so that a full sustainability perspective is used and trade-offs are avoided as much as possible.

4.2.2 Sustainable Purchasing

As mentioned in Section 3, HRM is a large purchaser of goods and services, directly through the procurement department and indirectly through its contractors (e.g. for capital projects). Currently, there are no formal programs in place to incorporate sustainability principles into the HRM's policies and guidelines for purchasing and developing contracts. **The incorporation of sustainability principles into procurement and contracts was frequently mentioned by many HRM staff as one of the most significant opportunities for improvement.**

Integrating sustainability principles into procurement policies means considering the best product and service options – those that provide the intended service at the lowest cost - while *also* helping support the goal of a healthy and sustainable community. The TNS Framework can be used to guide purchasing and contracting decisions to ensure, where possible, HRM is reducing or eliminating its contribution to violations of the four System Conditions.

Recommendation #5: Integrate principles of sustainability into HRM procurement policies

Ultimately, the most important lever for affecting the sustainability impacts associated with HRM's purchasing is its corporate Procurement Policy. Incorporating sustainability principles into procurement policies and procedures will help ensure that procured products and services provide the best service possible, while supporting the transition to sustainability at the lowest price possible.

Recognizing that a full-scale redevelopment of the Procurement Policy to incorporate sustainability principles would be a large endeavor, **HRM should consider initiating a pilot project as an interim step**. The pilot project could involve increasing the capacity of relevant staff on the TNS Framework and then focusing on a particular group of products or services (e.g. building materials). Lessons taken from applying the TNS Framework on a small group of products can then be extracted and formalized into policies that apply to a broader set of product areas and ultimately into the HRM's procurement policy as a whole.

4.2.3 Recycling Electronics and Light Bulbs

Electronics equipment and light bulbs contain mercury, a trace metal that if allowed to build up in concentration, may cause harm to human and ecological health. In addition to mercury, electronics equipment contains other trace metals such as cadmium, lead, and chromium, among others. Electronics equipment also contains persistent chemical compounds such as brominated fire retardants and additives in plastics. Again, if these substances are allowed to build up in concentration, they will lead to downstream negative effects. Trace metals and persistent compounds require a different perspective from that of traditional waste management because their potential negative effects are disproportionate to their relative tonnage. For example, a relatively small mass of brominated fire retardants can result in significant negative health effects.

Recommendation #6: Explore Opportunities to Recycle Electronics and Light bulbs

A logical and critical extension of HRM's impressive solid waste management program are programs to recycle electronics and light bulbs. Although HRM is awaiting direction and policy from the Province of Nova Scotia to guide its efforts on how to deal with electronics equipment, it is mentioned in this report as a recommendation in order to note that currently there are no initiatives to deal with this potential threat to community sustainability and health.

4.2.4 Composting HRM's Organic Waste

HRM provides an excellent composting program as a service to its citizens. On a corporate level, only the organic waste generated through the maintenance of parks and open spaces is composted. The rest of HRM (e.g. its offices and other buildings) does not have a program to collect organic materials. HRM places the expectation on its residents to recycle organic materials in order to support the goal of diverting 60% of collected household materials from landfill. In this sense, it is difficult to understand why HRM does not apply these expectations to itself and collect organic materials.

Recommendation #7: Institute Internal Composting Program

In addition to reducing the amount of methane in the atmosphere (SC1) and reducing need for increased physical spaced required by landfills (SC3), **instituting a corporate organics program can also bring HRM's corporate values more closely in line with those that it hopes to instill in residents**.

4.2.5 Sustainable Playing Fields

As described in the appendix titled Parks and Open Spaces, HRM has introduced two innovative approaches to managing its playing fields. First, it has instituted a program to use compost for fertilizer in a "green-bin to green field" program. In addition, a product called Field Turf as a substitute for grass on three of its playing fields. Field Turf is an artificial surface, made from plastic, with Nike Grind (ground up shoes, tires, etc) underneath. There are many efficiencies associated with Field Turf fields, as described in the Parks and Open Spaces appendix, and a broader use of this product may make a positive contribution to sustainability. However, Field Turf could also introduce some new sustainability challenges for HRM, depending on how it is managed at the end of life. For example, if the Field Turf is sent to landfill at the end of its useful life, it contributes to the challenges associated with that method of waste disposal.

Recommendation #8: Evaluate the Sustainability of Different Approaches to Managing Playing Fields

A more detailed sustainability analysis of the full life-cycle of the two alternative approaches to field management (i.e. Field Turf and "Green-bins to Green Fields") would clarify the impacts and benefits of both approaches. Such an analysis could have the benefit of ensuring a full and holistic view of sustainability is used to inform future plans for HRM's approach to managing playing fields, whether they involve an expansion of Field Turf fields or not. The supplier of Field Turf may be interested in supporting such an analysis. The Natural Step is currently developing templates for evaluating products and services from a strategic sustainability perspective, integrating the traditional Life Cycle Assessment (LCA) with the TNS Framework. This work may be useful if the HRM were to pursue an analysis of its playing field approaches and products.

4.2.6 Bio-diesel

HRM has initiated a pilot project to replace traditional diesel fuel in buses with a mixture of traditional diesel and bio-diesel, consisting of 20% fish oil, called "B20". This substitution represents a shift form non-renewable to renewable energy sources and is expected to result in lower carbon dioxide emissions. Although HRM should be commended for undertaking an initiative that reduces its dependence on fossil fuels (SC1), there are other challenges that need to be addressed if this program were to be expanded:

- The fish oil used in the production of B20 is considered a waste product of another manufacturing process (Omega 3), however there is potential contribution to over-consumption of fish stocks if the bio-diesel were used to meet all transportation needs. If this were the case, then this initiative may inadvertently create a new problem (systematic physical encroachment into nature (SC3)) while reducing the contribution to systematically increasing carbon in nature (SC1).
- In addition, the fish used to produce the fish oil is currently shipped to Nova Scotia over a large distance from Peru. This contributes to sustainability challenges associated with transportation (all SCs).
- Nitrous oxides (SC2) are still produced from burning B20. As with the combustion of fossil fuels, the result of an increase in concentration of nitrous oxides is the formation of smog, leading to poorer urban air quality, and acid rain. This problem is therefore not eliminated by the use of B20.

Recommendation #9: Prioritize bio-diesel produced from local, sustainably harvested feedstocks

As it considers any expansion of its bio-diesel initiative, HRM could explore opportunities to use sources of biodiesel from sustainably harvested stocks and from suppliers located closer to Halifax to address existing sustainability challenges. One question that would be worthwhile to explore is "what next?" Since the use and reliance on biodiesel still results in some sustainability challenges, a further investment in its use should be considered as a step towards a fully sustainable transportation system. By asking "what next?", HRM can explore whether or not (and how) biodiesel is a flexible platform for future improvement.

4.3 Building a philosophy of sustainability into corporate culture

Many actions are required to move HRM towards sustainability, and all internal stakeholders must play role. In order to do so, there is a need to align HRM learning and growth systems to support individuals in contributing to sustainability. A common set of principles that defines sustainability is useful in that they can serve as a common point towards which individuals can align their actions. However, educating people on sustainability principles is not enough by itself. Current systems, policies and strategies must also be designed with these principles in mind to support individual innovation toward sustainability.

The recommendations in the previous section are specific initiatives that HRM could take to align internal processes to support a transition to a sustainable and healthy community. This section will speak more to the opportunities to instill sustainability principles into organizational culture/systems and to increase organizational capacity for supporting the transition to a healthy, vibrant and sustainable HRM.

4.3.1 Integrate Sustainability Principles into Corporate Strategy

One of the four main themes in HRM's corporate scorecard refers to a "Healthy, Vibrant and Sustainable Community". Within this theme are desired citizen and financial outcomes linked to internal process and learning & growth outcomes. In other words, citizen and financial outcomes are the desired results and the internal process and learning and growth outcomes are the ways in which HRM's manages itself to achieve these desired results. The challenge is then to ensure that HRM's operations and investment in learning are aligned properly so that they are moving HRM closer towards the ultimate goal of sustainability. The relationship between a strategic management system, like the corporate scorecard, and a clear understanding of success is similar to the relationship between processes for running a good ship and a need for a compass. Although the processes maybe in place to sail the ship efficiently, a compass is still required to sail the ship in the desired direction. The corporate scorecard will ensure that HRM has the proper management routines in place and using sustainability principles as a guide ensures that HRM is moving in the desired direction.

Recommendation #10: Integrate the TNS framework as a guide for the "Healthy, Vibrant and Sustainable" theme of HRM's Corporate Scorecard.

Integrating principles of sustainability into the corporate scorecard will ensure that HRM is moving in the desired direction with respect to sustainability. Being strategic requires a shared understanding of desired outcome. If the outcome is sustainability, then it is important to make sure that this is defined clearly and for this definition to be used to guide the selection of targets, indicators and actions. There may be an opportunity for the group that is responsible for the "Healthy, Vibrant and Sustainable" theme to learn more about Sustainability Principles and use them in the development of the corporate scorecard, particularly to inform the internal process and learning and growth outcomes.

4.3.2 Create a Shared Understanding of Sustainability within HRM

Although a group of HRM staff participated it the development of this report, the majority of HRM staff are not familiar with the concept of sustainability and The Natural Step Framework, including Sustainability Principles. Staff education is always a crucial component, because it is ultimately the collective actions of many, rather than a few, which will move HRM towards sustainability. The idea of increasing organizational capacity fits well within the Corporate Scorecard, where raising awareness and education on sustainability supports sustainable operations, which in turn support the desired outcome of a "Healthy, Vibrant and Sustainable" community. Developing a shared understanding of sustainability is, therefore, an important part of aligning and making the most efficient use of resources.

Recommendation #11: Provide more opportunities for HRM staff to learning about sustainability

The model to raise awareness of sustainability can vary from organization to organization. It can include developing a dedicated team of people as trainers, who then provide workshops to colleagues, using new technologies such as online courses, or a mixture of both. Currently, TNS is developing an online course that will introduce the idea of sustainability and the basic concepts of the TNS framework and that can be used to disseminate this knowledge broadly in an organization.

4.3.3 Incorporate Sustainability Principles with ISO14001

ISO14001 is a widely recognized certification standard for environmental management systems. Although ISO14001 creates a process of continuous improvement, one criticism is that it does not provide a strategic element that defines success. In other words: a continuous improvement process to what end? Similar to the discussion with respect to the corporate scorecard in section 4.3.1, Sustainability Principles can be used to enhance the process of continuous improvement so that it moves systematically towards the desired outcome of sustainability, thereby creating a *sustainability management system*.[10] Currently, no HRM departments use Sustainability Principles to help guide their management system.

Please note that Sustainability Principles are not a substitute for management systems or ISO14001 certification. They are useful to provide direction to a process of continuous improvement when integrated into a management system.

Recommendation #12: Create a pilot project to explore how the TNS framework can be incorporated into environmental management systems

The development of a sustainability management system could be a pilot project for HRM to explore, particularity in a department that current has an environmental management system and is looking to explore how to improve it. For example, the Halifax Regional Water Commission has ISO14001 certification for its two main water supply plants and has demonstrated the kind of leadership that may be interested in this type of project. The process and lessons learned in a pilot project should be recorded so that they can be replicated in other departments.

[10] For more information on sustainability management systems please refer to: Macdonald, Jamie. (2004). Strategic Sustainable Development using the ISO14001 Standard. *Journal of Cleaner Production* (Forthcoming)

Appendix I: The Natural Step Framework

Summary

The Natural Step is an international organization that uses a science-based, systems Framework to help organizations and communities understand and move towards sustainability. The Natural Step engages in education and training, community outreach, advisory services and research. Founded in Sweden over a decade ago, The Natural Step has gained international recognition for its work, including The Blue Planet Prize and Global Green's Millennium Award for International Leadership. The Natural Step now has offices in ten countries: Australia, Brazil, Canada, Japan, Israel, New Zealand, South Africa, Sweden, the United Kingdom, and the United States.

The Natural Step Framework (TNS Framework)

The Natural Step uses a science-based, systems Framework to help individuals and organizations understand sustainability and build sound programs, tools and metrics. This framework is a well-developed planning methodology used for assessment, visioning and planning. Hundreds of municipalities, government ministries, universities, small and medium sized enterprises, and Fortune 500 companies worldwide are using the TNS Framework to develop strategic plans and initiatives on their journeys to sustainability. These initiatives have helped them achieve greater effectiveness in reaching their sustainability goals, creating collaborative partnerships, and better managing risk.

Why the TNS Framework?

Many tools, concepts, management systems and frameworks have emerged to help decision makers at all levels deal with the challenges of sustainable development. Unfortunately the variety of tools and approaches to the various problems only adds complexity to the search for solutions. Most people are still confused about what sustainability and sustainable development actually mean, and are paralyzed by the many choices available and the undefined links among them.

The Natural Step Framework cuts through this confusion by providing context to make sense of what people already know. It is a methodology for planning that provides an elegant, rigorous, science-based understanding of sustainability together with a proven planning approach to translate that understanding into practice. By focusing planners and decision-makers on that which can be agreed upon, it helps create a common perspective and language for sustainability. It enables organizations and communities to integrate environmental and social considerations into strategic decisions and daily operations. It is unique in its ability to bring disparate stakeholders and individuals together as intellectual partners to discuss the path forward to sustainability in a mutual exploration.

The key strengths of the TNS Framework lie in its conceptual structure and its implementation methodology. It is **not an alternative to tools, programs and data**, but rather should be used in conjunction with other tools, since it helps an organization select from among the many available tools and programs (e.g. ISO 14001, Life Cycle

Assessment, etc.) and design them to support a strategic journey to sustainability.

Why principles of sustainability for long-term planning?

Simplicity Without Reduction

Understanding the principles that define a given system, its first-order principles, makes it easier to handle the complexity of the details within the system.[11] The analysis begins at a level where complexity is naturally low, rather than at a level of detail where links to the principles of the system can be vague and difficult to discern.

In complex systems it is impossible to keep every detail in mind at the same time. But to efficiently handle complex systems it is helpful to first look for the principles that define the system and then, if necessary, move to higher levels of detail without neglecting these first-order principles. For example, cell respiration is a principle (condition) for survival of the animal cell. If respiration is stopped, the cell dies. Knowing this principle may be enough for some conclusions. If more detailed knowledge is found to be necessary for certain conclusions, the principle of respiration for survival is still valid and it offers a frame for the discussion of such details. The principle in no way denies the enormous complexity of animal cell life. This is simplicity without reduction.

First-order principles give a frame for the goal (the wanted outcome) of a plan. To know the frame is a prerequisite for effective envisioning of the goal. Furthermore, the frame is a prerequisite to determine which sub-goals actually bring us closer to the goal - and, conversely, to determine which sub-goals are only providing short-term benefits without bringing us closer to the goal, or which may even hinder a further development towards the goal. To elaborate first-order principles for “upstream thinking”, rather than ”quick fix solutions” downstream, is a sound way of avoiding serious economic problems in business.[12]

Planning from Success in Complex Systems

A framework for long-term planning in complex systems should keep five essential hierarchal levels apart and not confuse them with each other – (i) the System level, (ii) the Success level, (iii) the Strategic level, (iv) the Action level and (v) the Tools level.

At the heart of planning and cooperation is level (ii) – success. It should inform strategies, actions and the design of our tools. It occurs through backcasting from success principles, i.e., imagining that the conditions for success are complied with, and then proceeding by asking: “what shall we do now to optimize our chances of getting there?”

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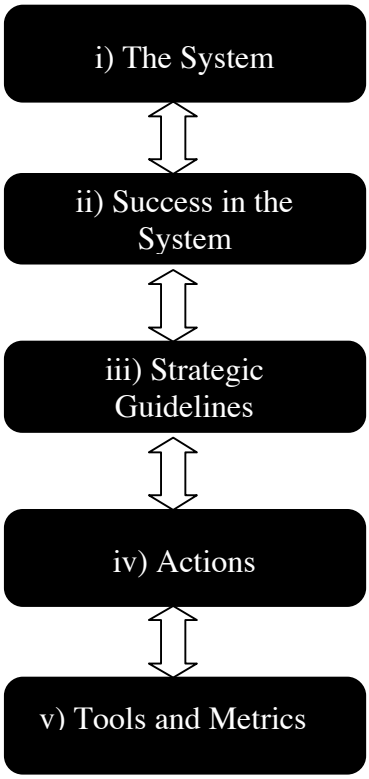
[11] Simplicity Without Reduction: Thinking Upstream Toward a Sustainable Society. Broman, Göran; Holmberg, John; Robèrt, Karl-Henrik.

[12] Senge, Peter. (1994). *The Fifth Discipline: The Art and Practice of the Learning Organization.* Doubleday: New York

What is "success" in sustainability?



In order to arrive at a principle definition of (ii) success – in this case sustainability – we must know *enough* about the (i) system – in this case the biosphere, human societies and the interactions and flows of materials between the two. Since the concept of (ii) *sustainability* becomes relevant only as we understand the unsustainability inherent in the current activities of society, it is logical to design principles for sustainability as restrictions, i.e., principles that determine what human activities must *not* do in order to avoid destroying the (i) system. CFCs were "harmless" yesterday, but which compounds will be harmful tomorrow? In what principle ways could we destroy the biosphere/society's ability to sustain us? This question is answered by looking *upstream* in cause-effect chains, where basic errors of societal design trigger the thousands of negative impacts occurring downstream.

Redesign within basic constraints of sustainability is the only way of tackling our current problems sufficiently upstream, and thereby avoiding new problems looming in the future. At this level, complexity is at its lowest, and the comprehension that follows from understanding this level makes it possible to ask the right questions and to structure all the details in a way that makes sense from a decision making point of view. With an added "not", such basic principles for destroying the system would be conditions for the whole system (Biosphere and Society) – "system conditions".

The negative impacts related to unsustainability encountered today can – on the basic principle level – be divided into three separate mechanisms by which humans can destroy the biosphere and its ability to sustain society:

1. A systematic increase in concentration of matter that is net-introduced into the biosphere from outside sources.

2. A systematic increase in concentration of matter that is produced within the biosphere.

3. A systematic degradation by physical means.[13]

The system conditions specify how to avoid the destruction of the biosphere. Together, the first three basic principles provide a framework for ecological sustainability that

[13] Azar, C., Holmberg, J. and Lindgren, K., 1995. **Socio-ecological indicators for sustainability.** Ecological Economics, 18, 89-112.

implies a set of restrictions within which sustainable societal activities must be incorporated. Sustainability of society also depends on the maintenance and robust functioning of social systems – formal institutions as well as the informal structuring of civic society at large. This is required not only to sustain society itself, but also to comply with the first three ecological constraints. This requires a fourth basic condition that takes social sustainability into account:

In the sustainable society, nature is not subject to systematically increasing…

I …concentrations of substances extracted from the Earth's crust[14],

II …concentrations of substances produced by society[15],

III …degradation by physical means[16]

and, in that society. . .

IV…people are not subject to conditions that systematically undermine their capacity to meet their needs.[17]

These four socio-ecological principles for sustainability are referred to by The Natural Step as the **System Conditions for Sustainability**.

Description of Approach

The TNS Framework uses a planning approach called "Backcasting from principles." *Backcasting* is a methodology for planning that involves starting from a description of a successful outcome, then linking today with that successful outcome in a strategic way: what shall we do today to get there?

The TNS Framework uses the scientifically rigorous principles of sustainability, or system conditions, described above, as the basis for its definition of success from which to backcast. It translates the system conditions for a sustainable society into ultimate *sustainability objectives* for an organization or community, namely to:

- *…**eliminate its contribution to systematic increases in concentrations of substances from the Earth's crust***. This means substituting certain minerals that

[14] This means substituting certain minerals that are scarce in nature with others that are more abundant, using all mined materials efficiently, and systematically reducing dependence on fossil fuels.

[15] This means systematically substituting certain persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and using all substances produced by society efficiently.

[16] This means drawing resources only from well-managed eco-systems, systematically pursuing the most productive and efficient use both of those resources and land, and exercising caution in all kinds of modification of nature e.g. overharvesting and introductions.

[17] This means checking whether our behaviour has consequences for people, now or in the future, that restrict their opportunities to lead a fulfilling life, by asking ourselves whether we would like to be subjected to the conditions we create.

are scarce in nature with others that are more abundant, using all mined materials efficiently, and systematically reducing dependence on fossil fuels.

- *…**eliminate its contribution to systematic increases in concentrations of substances produced by society***. This means systematically substituting certain persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and using all substances produced by society efficiently.

- *…**eliminate its contribution to systematic physical degradation of nature through over-harvesting, introductions and other forms of modification***. This means drawing resources only from well-managed eco-systems, systematically pursuing the most productive and efficient use both of those resources and land, and exercising caution in all kinds of modification of nature.

- *…**eliminate its contribution to conditions that undermine people's capacity to meet their needs***. This means checking whether our behaviour has consequences for people, now or in the future, that restrict their opportunities to lead a fulfilling life, by asking ourselves whether we would like to be subjected to the conditions we create.

TNS uses the metaphor of a *funnel* to represent the declining room to maneuver of our society, due to the systematic declining potential of natural systems and the increasing demand on natural systems that form the crux of sustainability. In this metaphor, the system conditions represent the point at which the walls of the funnel become parallel – i.e. sustainability.

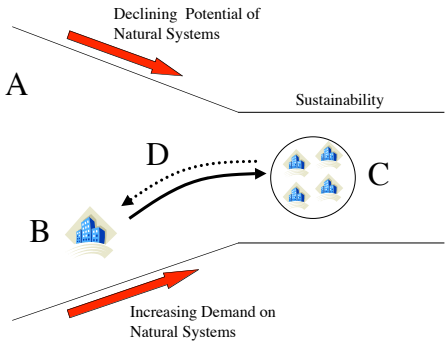


Figure 2: The "ABCD" Process

Each individual organization must draw its own conclusions from the sustainability objectives as regards to problems, solutions, and goals. The four-step "A-B-C-D" process below provides a systematic way of guiding this process (shown in Figure 2).

(A)wareness: The TNS Framework – including the four System Conditions, the step-by-step approach to comply with them, and the strategic motivation for doing so – is shared as a mental model for community building amongst the planning participants (i.e., "playing the game Sustainable Development by the same rules").

(B)aseline: An assessment of "today" is conducted by listing all current flows and practices that are contributions to violations of the four System Conditions, as well as considering all the assets that are in place to deal with the problems. Questions to ask include: How is my organization contributing to systematically increasing concentrations of substances from the Earth's crust? …concentrations of substances produced by society? …degradation of nature by physical means? …conditions that undermine people's ability to meet their basic human needs?

(C)ompelling Vision - Opportunities for Innovation: Solutions and innovation for "tomorrow" (i.e., the opening of the funnel) are created and listed by applying the constraints of the system conditions to trigger creativity and scrutinize the suggested solutions. Questions to ask include: If my organization were to provide its services in a sustainable manner what would it look like? What actions could we take to get there?

(D)own to Action: Priorities from the C-list are made, smart early moves and concrete programs for change are launched, metrics are identified for measuring progress. Innovative actions are prioritized by screening them with the three following questions:

1. Does it move us in the right direction with regards to the four system conditions?
2. Is it a flexible platform[18], i.e. a stepping stone toward future improvements?
3. Does it provide an adequate return on investment to seed future investments?

These three questions help prioritize actions and investments that move the organization in a step-by-step manner towards compliance with the four System Conditions.

[18] Choose solutions that are as flexible as possible, otherwise you might end up in a dead end. If technical or economic conditions change investments in flexible solutions will ensure that adjustments do not bring punitive costs.

Appendix II: Land-Use & Transportation

Overview

The HRM's total land mass encompasses 5,577 square kilometers, a piece of land larger than Prince Edward Island, and contains a mixture of privately-owned and Crown-owned forested areas, lakes, settled areas, and over 2400 km of coastline.

Land use and transportation are affected by population, population density, and urban design. The current population of HRM is just under 360,000. From 1996 to 2001, the population grew almost 5%, or at a consistent increase of about one percent per year. The growth rate over the next 25 years is expected continue by one percent per year. At this rate of growth, the population of HRM by 2038 is expected to increase by 75,000 to 100,000 to almost half a million residents.

The consumption of land per person in the HRM has quadrupled since the 1960s. At current rates of land consumption, approximately 50,000 more acres would be required for residential land. Currently, 27% of residents live inside the downtown core, while 49% live in the suburbs, 21% live in the rural commutershed (in rural areas but commuting to the urban core), and 3% live in rural areas not within commuting distance to the urban core. The fastest growth in development is in rural commutersheds. If this trend continues, population in this area will grow by 50% over the next 25 years, leading to many more vehicles on the road if transit services are not improved. 68% of commuters in the HRM drive to work (less than the national average of 71%), and 86% of people who live in rural areas drive to work, primarily because public transit is not readily available. Currently, 10% of HRM residents take public transit to work - higher than other maritime cities such as St. John's (3%) or Saint John (4%) and comparable with Victoria, B.C.

HRM is currently engaged in the development of a Regional Plan that will guide development over the next 25 years. References to the Regional Plan and its various strategies are made in the Transition Guidelines. Three related issues are covered in other appendices: facilities, water, and vehicles.

Facilities (e.g. buildings) are where residents live, work and play. How a building is designed (including selection of materials), built, operated, and managed at the end of its life determines its sustainability impacts. A discussion on buildings can be found in the *Capital Projects (*design, materials selection, end-of-life management), *Maintenance and Operations* (maintenance)and Solid Waste (end-of-life management) sections.

- Vehicles are used to travel to work and play, to transport goods, and to provide services. Vehicles are a ubiquitous part of the lives of HRM residents. A discussion on the sustainability challenges around purchasing, maintaining and disposing of vehicles can be found in the appendix titled *Fleet Services.*

- Water is a key resource in the lives of HRM residents, both to provide nourishment and for a number of other home and industrial functions. A

discussion on water can be found in the appendices titled *Water Supply* and *Wastewater*.

Sustainability Objectives

Sustainable land use and transportation of the future will ultimately provide seamless access to residences, as well as commercial and public services, for visitors, residents, goods and services, while achieving the acha four Sustainability Objectives[19], which are to:

SO1) …eliminate the contribution of land use and transportation in HRM to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of land use and transportation in HRM to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of land use and transportation in HRM to systematic physical degradation of nature;

SO4) …eliminate the contribution of land use and transportation in HRM to undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of land use and transportation in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

1. To meet transportation needs, **energy** is consumed primarily in the form of gasoline and diesel. Following current growth patterns, another 70,000 vehicles are expected to be on the road by 2028 (900,000 km in extra car travel every day). This would mean an extra 45,000 tonnes of greenhouse gas emissions each year.

    - Globally, transportation generates 21% of greenhouse gases. The combustion of *fossil fuels* results in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. According to a study by *GPI Atlantic*, the levels of NO_2 in Halifax have decreased by 20% from 1976 and 2001, and ground-level ozone has decreased by 43% from 1977 to 2001, although concentrations of ground level ozone are comparable to those found in Toronto and Hamilton. In 2001, Halifax had the highest level of SO_2 concentration of any commercial site in Canada, between 2 and 12 times the

[19] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to Section X "Introduction to the Natural Step Framework for Sustainability".

levels found in other cities. Although the majority of air pollutants in Halifax are due to electricity generation from coal - either locally or transported from the US - local transportation is also identified as a source of these pollutants and their systematic accumulation results in downstream effects such as climate change, acid rain, poor air quality, and negative human health effects (SO4).

- The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

2. A significant area of **land** in Halifax is used for settlement areas and transportation infrastructure and this area is expected to grow in the future.

    - As mentioned above, the consumption of land per person in HRM has quadrupled since the 1960s. The use of land for development is primarily related to Sustainability Objective #3, contributing to the systematic degradation of nature by physical means, such as removing forests, draining wetlands, fragmenting wildlife habitat, and paving over natural areas for development. Achieving Sustainability Objective#3 does not mean that no land can be used, but rather that a development strategy is not sustainable if it reinforces the need for ever-increasing consumption and modification of natural areas.

    - It should also be noted that the contamination of coastlines follows settled lands. Approximately 20% of the HRM's coastal areas have been closed to shellfish harvesting either periodically or permanently. While natural toxins account for some of these closures, many are caused by contaminated run-off from rivers and streams.

    - The transportation infrastructure expands in line with the growth of suburban and rural areas. The systematic increase of transportation infrastructure is not sustainable in the long-term (SO3), as it will lead to a systematic physical degradation of nature. Whereas emissions such as sulfur, carbon and nitrous oxides indirectly disrupt natural cycles (e.g. through acid rain and climate change), the physical expansion of infrastructure into natural areas directly disrupts natural cycles.

3. To build and service municipal infrastructure requires a number of **material** inputs. When HRM purchases materials, the production process by which they are made and the mode and distance of transportation by which they are supplied lead to a number of sustainability challenges. Although a detailed analysis of these materials is beyond the scope of this analysis, a brief discussion of some significant materials is provided below.

    - *Cement* is a major component of transportation infrastructure. Most HRM construction projects are contracted out and materials are included in that lump sum, so therefore there are no data for the quantity of cement used. According to

an industry[20] report, the major sustainability challenges of producing cement include emissions of CO_2, SO_2, and metals (SO1), emissions of persistent chemical compounds, e.g. dioxins, (SO2), the generation of solid waste ending up in landfill (SO3), the depletion of groundwater (SO3), and the physical degradation of nature due to resource extraction, e.g. mining, (SO3).

- There are 235 intersections in Halifax, each with between 6 to 20 *traffic signals*. These signals, in addition to street lamps, help ensure safety in the transportation system. Traffic signals and street lamps are a significant consumer of energy (see above for energy-related sustainability impacts). They also contain trace metals (SO1), such as mercury, in the bulbs themselves. Mercury in light bulbs is a sustainability challenge if it is allowed to systematically increase in nature. Since mercury is a relatively scarce metal in nature, even small human-made flows of it into nature can cause a quick rise in concentration. Mercury does not breakdown and accumulates in wildlife (e.g. in fish) and ultimately in humans (SO4). This does not mean that HRM should never use mercury, however, if HRM relies on scarce metals to provide services, it is important to make sure that they are kept in tight technical cycles so that they are not released into nature. Currently, when signals are replaced, they are refurbrished for re-use or scrapped.

- HRM uses an average of 35,000 tonnes of *road salts* each year. Road salts are corrosive and lead to damage of plant and animal life (SO3). In addition, they often contain phosphates to inhibit corrosion, and if they exist in sufficient concentrations may cause downstream effects such as the eutrophication of lakes (SO3).

Please note that there are many other materials that HRM uses to build and service its infrastructure, including paints, granite, and road salts, among others. The use of these materials in the near- and mid-term is necessary, however, in the long-term the reliance on materials that do not help to attain the four sustainability objectives is ultimately not sustainable.

4. Two main features of our land use practices over the past several decades have converged to generate haphazard, inefficient, and unsustainable development sprawl – zoning regulations that separate housing, jobs, and shopping, and low density development that requires the use of the car.[21] This has lead to many social sustainability challenges, including:

    - Increased amounts of **time wasted** in traffic (SO4). Since 1970, vehicle miles traveled have increased by 121%, more than four times the population growth over that same period in Canada. This leads to more congestion and more time

[20] For more information, please see a report commissioned by the World Business Council on Sustainable Development (WBCSD) titled *Towards a Sustainable Cement Industry* released in March of 2002.

[21] American Planning Association. (2002). Policy on Planning for Sustainability. http://www.planning.org/policyguides/sustainability.htm

wasted in traffic[22]. For example, there is a problem with limited access roads to the Halifax Peninsula, where the majority of residents travel to work. Expanding infrastructure to access the Peninsula is expensive and, therefore, new ways to deal with the increased demand must be found.

- **Inefficient use of public funds** (SO4), as municipalities are forced to extend services such as sewer and water infrastructure, garbage collection, road construction and maintenance, etc, to low-density developments further and further from the community center. For example, HRM predicts that it would need to spend over $150 million to satisfy the demand for new or expanded roads by an estimated population of 400,000 by 2028. This is over 100 times the amount currently spent on transportation in a single year, meaning that other public spending items would likely have to become lower priorities.
- Excessive reliance on automobile transportation can contribute to an inactive daily lifestyle, which is one of the factors in the emerging **obesity** crisis (SO 4).
- Some have argued that land-use patterns that separate residential zones from commercial and other zones **hinder social interaction** and community participation that build community and encourage a sense of neighborhood, which is essential for meeting social needs (SO4). This applies to the ability of the HRM to create a sense of community both downtown and in centres outside the urban core.
- Although not directly related to the issue of urban sprawl, another important social sustainability challenge facing municipalities is a lack of access to **affordable housing**. This is a condition that undermines people's ability to meet their needs both through limited access to shelter and by limited financial resources to pay for other items, such as food. In 2001, 44% of rental households in Halifax paid more that 30% of their income on shelter, one of the highest percentages in the country. One of the causes of this high percentage is the high level of university students in Halifax renting apartments, since students tend to spend a high level of their income on housing.

Transition Guidelines

Making a shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from transportation are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over

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[22] In the greater Vancouver area, [0]for example, traffic volume grew by twice as much as population from 1996 to 1999, resulting in an increase in average of trip time by 33% and "rush hours" that last 33% longer.[22] Traffic congestion is estimated to cost the U.S. $168 billion in lost productivity.

others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From land-use and transportation that…	To land-use and transportation that…
1	**Uses non-renewable energy sources (such as gasoline or diesel)**	**Uses renewable energy sources, such as biodiesel, electric or hydrogen (from renewable power sources**
1	**Promotes the use of low mileage and single or low occupant vehicles**	**Promotes the use of high mileage and multi-passenger vehicles**
1 and 4	**Facilitates transportation mainly by private automobile**	**Facilitates mass transit, car-sharing, cycling, and walking with low or no per capital emissions**
A Step in the Transition: Regional Planning Focused on Enhancing Transit HRM is currently developing a Regional Plan to guide development over the next 25 years. One of the key core strategies informing the regional plan is to enhance the role and scope of public transit. The *Guidebook to HRM's Alternative for Growth* lays out three options for development where public transit is a key feature. For example, Alternative B, "Transit-link Community Hubs", features smaller communities around a regional centre (Halifax-Dartmouth). This alternative has "fast and frequent public transit service" linking each community to the regional centre. Transit also passes through other communities en route to the regional centre, thereby also providing transit service between hubs. By increasing the use of public transit, HRM can reduce the sustainability challenges associated with the private use of vehicles such as increasing concentrations of CO_2, SO_2 (SO1), and NO_2 (SO2), with its associated downstream effects, such as harm to human health (SO4). HRM can also reduce the systematically increasing need for land for transportation infrastructure to support an increasing number of private vehicles (SO3). A Step in the Transition: Bicycle Plan In December 2002 the Halifax Regional Municipality Bicycle Plan was released. The plan states a goal of *doubling* by 2010 the average annual modal share of cycling (currently 1% of total commuters), while decreasing the number of bicycle related-injuries and fatalities. The Bicycle Plan will accomplish this through the use of existing and planned infrastructure, developing and maintaining new infrastructure to encourage bicycling, providing programs that promote bicycle safety and use, and incorporating planning for cycling into all relevant municipal activities. HRM has recently received funding to develop a commuter trip reduction program to encourage a shift in transportation modes away from private automobiles to bicycles and public transit.		
1	**Uses low energy efficiency building construction and operations**	**Incorporates energy conservation and efficiency through neighbourhood and building design, construction and operations.**
1 and 2	**Uses materials for infrastructure containing scarce metals synthetic materials with no consideration to closing the loop**	**Uses materials for infrastructure that use closed loop approaches, in addition to abundant metals and are renewable**
1, 2, and 3	**Facilitates large buildings that are**	**Encourages and rewards compact,**

	rarely occupied	**livable and mixed-use buildings**
3	**Cumulatively expands the surface area of roads so that development is further from the urban centre**	**No longer expands the built surface area so that development is closer to urban centre**
3	**Cumulatively expands the surface area of roads and parking areas into natural areas and special local habitat (e.g. wetlands, riparian areas)**	**No longer expands the built surface area and make more efficient use of existing land, roads and parking areas**

A Step in the Transition: Regional Plan – Protection of Open Spaces.

One of the key foundations of the Regional Plan that HRM is currently developing is the protection of open spaces. The approach basically involved first identifying the lands that HRM wants to protect, and then planning development accordingly. As part of this strategy, HRM would strive to award development permits based in part on consideration of environmental protection standards (though this requires cooperation with the provincial government authorities). In addition, HRM could also take other regulatory measures such as amending zoning and land-use bylaws, acquiring certain lands to ensure protection, and negotiating agreements where landowners agree to protect specific features.

A Step in the Transition: Regional Plan – Developing Brownfields

Another key objective of the Regional Plan that HRM is currently developing is to "ensure the efficient and effective use of existing and future infrastructure". One initiative that HRM could take is the development of brownfield sites. In research performed in preparation of the Regional Plan, HRM found that if all brownfield sites were developed, then almost 9,000 acres in greenfields could remain undeveloped to accommodate population growth. Additionally, this would raise tax revenue and reduce the costly extension of piped infrastructure.

A Step in the Transition: Growth Moratorium

In June 2004 HRM announced a moratorium on approvals of new large-scale housing developments in most areas not serviced by municipal infrastructure. The moratorium was put into place during the development of the Regional Plan to ensure that its key strategies such as those described above are not made irrelevant by a flood of new developments outside planned service areas, thus requiring an expansion of municipal infrastructure.

3	**Promotes developments requiring intensive use of water**	**Promotes developments that conserve water**
4	**Features infrastructure that is designed primarily for private vehicle access to residences, commercial and recreational facilities**	**Features infrastructure design that utilizes more efficient patterns of development and primary modes of transport (e.g. walk or bike to transit stops, storage available at key nodes)**

A Step in the Transition: Regional Planning - Compact, Mixed – Use Developments The *Guidebook to HRM's Alternatives for Growth*, prepared as part of the Regional Plan process, features three scenarios that include mixed-use, compact developments. Research performed in preparation of the Regional Plan found that the more land uses are mixed the more likely people are to walk and less likely they are to drive and that land use density increases accessibility by shortening average trip lengths for all travel modes. A Step in the Transition: Expansion of Park-and-Ride Facilities There are a number of improvements to Park-and-Ride facilities proposed in the Metro Transit Strategy to increase access to transit in rural areas. Improved Park-and-Ride facilities are particularly important for providing transit access to small communities and rural areas that cannot justify local bus service.		
4	**Features infrastructure choices that are wasteful with regard to their use of energy, materials, and land**	**Features infrastructure choices that are efficient with regards to use of energy, materials and land**
A Step in the Transition: Regional Plan – Full-cost accounting As part of the Regional Plan, HRM is going to quantify the cost savings of the alternative scenarios using a full-cost accounting methodology to evaluate the impact of their associated infrastructure and service needs on the municipal budget.		
4	**Promotes isolation, allowing few opportunities for safe and spontaneous personal encounters (e.g. traffic jams, single occupant vehicles)**	**Allows many opportunities for save and spontaneous encounters between individuals (e.g. pedestrian plazas, trails, neighbourhood commercial areas**
4	**Limits public access to recreation opportunities**	**Provides access to public recreational facilities (public plazas, parks, trails)**
4	**Disregards the history and heritage of Halifax and its surrounding areas**	**Explores and celebrates Halifax's history and heritage**
A Step in the Transition: Heritage Incentive Programs Halifax Regional Council approved two Heritage Incentives Programs for 2004. Once a Heritage Home Grants, up to $5000, for minor repairs and restoration of municipally registered heritage homes. The second, Heritage Facade Grants, up to $10,000, for signage, lighting and minor repairs of municipally registered commercial heritage facades.		
4	**Features commercial, recreational, and residential options that are becoming systematically more expensive**	**Features commercial, recreational, and residential options that allow basic needs to be met in an affordable manner**
4	**Is available only to higher income groups**	**Is equally available to all income groups**

A Step in the Transition: University Tuition Passes

One of the strategies to make transit more accessible to a wide range of people is the proposed introduction of a pass provided at a reduced rate to university students. This pass is expected to result in a major increase in transit ridership. Some universities in Halifax have already agreed to participate in the program.

Appendix III: Procurement

Overview

Halifax Regional Municipality (HRM) is one of the largest purchasers in the Halifax region. Annual total purchases are estimated to be $100 million dollars, with $60 to 70 million accounted for by capital purchases and the remainder for operating purchases.

Procurement is a division within the Financial Services department of HRM. Procurement staff is responsible for the process of procurement that includes tendering offers, receiving products, storing products, and disposing of products at the end of life. Five buyers are responsible for purchases between $1,000 and 50,000 and three coordinators work with business units for purchases over $50,000. Purchases under $1,000 are made at the discretion of each individual business unit.

Product specifications are developed in conjunction with each business unit, because staff relies heavily on business unit expertise about which product to purchase. Procurement staff review specifications to make them as generic as possible, as HRM is required by their policy to make the procurement process as open as possible to local community suppliers and to meet specifications at the lowest costs.

Sustainability Objectives

Sustainable procurement practices of the future will ultimately procure products that achieve the acha four Sustainability Objectives[23], which are to:

SO1) …eliminate the contribution of products and services procured to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of products and services procured to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of products and services procured to systematic physical degradation of nature;

SO4) …eliminate the contribution of products and services procured to undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of procurement in HRM with respect to the four Sustainability Objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

[23] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to Section X "Introduction to the Natural Step Framework for Sustainability".

Many of sustainability challenges of major product categories purchased by HRM are discussed in other sections of this document. These include fuel, vehicles, lights, construction services, and electronic equipment, among others. Rather than providing a detailed analysis of each product, the *Current Reality* section will provide the sustainability challenges associated with products in general. A useful way to discuss the current sustainability challenges of products is through the different stages of a product life-cycle, including the harvesting of raw materials, the production and transport of products, the use of products, and the end-of-life management of products.

Harvesting Raw Materials

- Metal, minerals, and fossil fuels are extracted from the Earth's crust to provide raw materials for products (SO1). Trees and crops are grown and harvested to provide raw materials for products. Mining or forestry practices contribute to the systematic degradation of nature by physical means, e.g. *strip-mining or clear-cutting* (SO3). Some businesses have adopted practices that mitigate degradation by physical means, such as remediation of land and selective harvesting of trees.

- Some metals that exist in the Earth's crust exist in small quantities in nature. These include metals such as mercury, cadmium, uranium and lead, amongst others. Societal flows of materials are entering into nature from the Earth's crust at a faster rate than nature can assimilate them, leading to a systematic increase of these metals (SO1) (e.g. the large flow of electronics equipment). As the concentration of these metals increases in nature, so do the negative consequences to environmental human health, such as finding cadmium in kidneys or mercury in fish.

- Often, raw materials are harvested in remote areas near small communities. These communities depend on the resource to provide livelihood to their citizens. This can be a positive driver for sustainability (e.g. provide economic resources) or a negative driver (e.g. providing low wages or causing harm to environmental and human health) (SO4).

- Raw materials can also be used to provide energy in the case of fossil fuels and plants (e.g. wood or bio-fuels). Burning fossil fuels leads to an increase in the atmosphere of substances from the Earth's crust such as carbon (CO_2, CO), sulphur (SO, SO_2), and metals (e.g. mercury) (SO1). This systematic increase leads to negative downstream effects such as climate change, acid rain, smog, and human health problems.

Production and Transport of Products

- Raw materials are often combined together to form new materials that do not exist in nature – e.g. PCBs, DDT, VOCs and CFCs. More recently brominated-fire retardants, used in electronics equipment and on fabrics, have become a concern. Since these substances are foreign to nature, nature has not developed mechanisms to break them down, and, as a result, they accumulate (SO2). Toxicity is only a function of concentration, i.e. anything is toxic at a certain

concentration, even water. Therefore, as society increases the concentrations of these substances in nature (e.g. through waste streams, accidental spills, and within products), their concentration is slowly getting closer to toxicity thresholds.

- The manufacturing process and transportation also requires energy input, generally derived from fossil fuels. In addition to sustainability challenges with introducing carbon, sulfur and metals mentioned in the previous section, the high temperatures associated with combustion of any type of fuel also results in the increase of nitrous oxides (NO, NO_2) in the atmosphere (SO2). A systematic increase of these nitrous oxides, results in downstream problems like acid rain and smog.

- Physical infrastructure, such as office buildings, factories and roads, require the use of land. If new buildings and roads are built consuming ever-increasing areas of land, then this is ultimately not sustainable. For example, the dependence on motor vehicles to transport goods contributes to an ever-increasing need for roads (SO3). In the long-term this trend is not sustainable, because it leads to they systematic physical degradation of nature.

Use of Products

Please note that this section also applies indirectly to HRM through contractors who provide services, but ultimately depend on products to provide them.

- Many products consume energy and water during use. As mentioned before, energy derived from fossil fuels has numerous sustainability challenges (see above). Products that consume less energy can reduce the impact of these challenges. Water is a resource that requires energy and infrastructure to purify. Over-consumption of water will reduce the availability of this resource for current and future generations (SO4).

- Using materials and energy in an inefficient manner (SO4) will increase the sustainability challenges associated with the harvesting of raw materials and the production and transportation products (see above). Reducing consumption of products in general will help to achieve the sustainability objectives.

- Many products are also used in a way that causes them to dissipate (e.g. road salts, cleaning products, paints). Since these products are used in a dissipative manner, one should take care that they do not contain chemical compounds that build up in nature (e.g. volatile organic compounds) (SO2), nor scarce metals (e.g. mercury) (SO1). Even relatively small flows of these substances directly into nature will result in their systematic increase.

End of Life Management of Products

- Many products are designed for disposal after use and end up in landfill (e.g. packaging). Depending on landfills as a method to manage materials is not

sustainable in the long-term, as this will result in ever-expanding landfills requiring an ever-increasing amount of land (SO3).

- If organic materials are disposed of in landfills, they will decompose in an environment without oxygen and form methane gas (SO2). Methane gas is relatively scarce in the atmosphere compared to other gases, and therefore a small societal flow of methane can cause an increase in concentration. This increase in concentration results in negative environmental effects such as climate change.

- Recycling materials is another way to manage materials after use. Recycling refers to the reuse of materials in the same application and indefinite number of times. For example, aluminum is recycled when it is reused to make cans. However, what occurs most of the time is the downcycling of materials. This is where materials are reused, but for lower quality applications. For example, plastic bottles can be made into fleece, but the process cannot be reversed to make plastic bottles from fleece. Downcycling is a more efficient use of resources (SO4) than waste disposal, however the challenge with downcycling is if materials are subsequently used for lower quality applications, then ultimately their fate is still the landfill (SO3).

Transition Guidelines

Making a shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current procurement initiatives are described under the relevant guidelines to highlight how they support the transition to sustainability.

Although the business unit determines the exact specification for each product, the procurement division sets policies that guide the development of specifications. For example, the procurement policy states that the specification should be generic enough to be open to competition for all local businesses. Currently, no formal policies have been developed that take into account social or environmental criteria. The guidelines listed below can provide some input into what policies could be developed to support a transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From products and services that:	To products and services that:
1	Use non-renewable material sources (such as petroleum products – e.g. nylons, polyester, etc.) for service provision	Use renewable material sources
1	Use non-renewable energy sources for product development and transport	Use renewable energy sources for production and transport

	transport	
1 and 2	**Use scarce metals and synthetic materials as product ingredients (e.g. cadmium, mercury, lead, VOC's in carpets, etc)**	**Use renewable, sustainably harvested materials and plentiful metals (e.g. iron, aluminum, silica)**
3	**Use large amounts of natural materials that contribute to physical degradation of natural areas**	**Use natural materials efficiently from sustainably harvested sources**
3	**Rely on intensive use of water for product/service sourcing and delivery**	**Rely on water conserving product/service sourcing and delivery**
4	**Use wasteful and low efficiency production processes from very remote locations**	**Use high efficiency production processes primarily from regional and local locations**
4	**Give no consideration to labour standards or human rights in places where the products were manufactured**	**Consider people's basic needs by considering labour standards and human rights in places where the product is manufactured**
4	**Are discharged as solid waste after use**	**Are kept 'in the loop' through re-use, recycling and manufacturer responsibility**

A Step in the Transition: Take-back Agreements on Electronics Equipment

Currently, HRM uses lease programs for electronics equipment such has computers, photocopiers, and printers. Although lease programs with manufactures differ, they are an example of a "take-back" program, where manufacturers are responsible for the physical product after the customer is done with it. Manufactures who design the components of their products to be reused have an economic incentive to develop components that are very durable and divert components from landfill or, in some areas, incineration. This is important considering the existence of scare metals (e.g. mercury, copper) and persistent compounds (e.g. brominated fire retardants) found in electronic equipment. The concept of "extended producer responsibility" can extend to all products.

Appendix IV: Solid Waste

Overview

The Solid Waste division of the HRM's Environmental Management Services department is responsible for collection of waste materials from households, processing of waste materials from both households and businesses, and planning for diversion of waste streams from landfill (e.g. public education and enforcement of waste related bylaws). In 2003, HRM collected111,585 tonnes of materials from 125,000 *households* in HRM, including 66,262 tonnes of refuse, 28,828 tonnes of organics and 16,495 tonnes of recyclable materials (e.g. metals, plastics, glass). In addition, HRM received 89,977 tonnes of refuse and 12,862 tonnes of organic materials from *businesses and special events*. Every year since 1999 50% to 55% of household materials has been diverted from landfill, with the target of 60% in 2004. HRM does not currently use economic instruments such as charges per bag of garbage to reduce waste.

The Solid Waste division has 12 staff and a budget of approximately $30 million. Each year, $15 million of revenue is generated from tipping fees, waste diversion credits[24], and the sale of compost and recyclables. The majority of collection and processing services are provided through contractors accounting for $28 million of the total budget. Therefore, the department also has a significant administrative responsibility (e.g. managing and negotiating contracts, monitoring contractor performance). The primary assets of the Solid Waste department consist of two landfills, one mixed waste processing facility, one materials recovery facility, two composting facilities, and a small fleet of long haul trailers.

Sustainability Objectives

A sustainable materials management system in the future will ultimately keep all materials within a closed loop system. This means that all materials are either used as nutrients for technical or natural processes. In this system, there is nothing considered waste. While a detailed picture of how this system will look is uncertain, in principle this system will achieve the acha four Sustainability Objectives[25] to:

SO1) …eliminate the contribution of a materials management system to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of a materials management system to systematic increases in concentrations of substances produced by society;

[24] HRM receives credits from a Resource Recovery Fund Board for each tonne of waste that is diverted from landfill. For more information visit the Resource Recover Fund Board website at www.rrfb.com.

[25] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to Section X "Introduction to the Natural Step Framework for Sustainability".

SO3) …eliminate the contribution of a materials management system to systematic physical degradation of nature;

SO4) …eliminate the contribution of a solid waste system to the undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of the solid waste management system in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

I. HRM's **solid waste management system acts as a catalyst** to allow households and organizations to **manage materials in a more sustainable manner**. The system allows many materials to be kept in either a *technical cycle*, in the case of batteries and paints, or in a *natural cycle* in the case of organic materials. Managing materials within these cycles prevents them from becoming waste, since waste does not become waste until it is wasted. Managing materials coming from households create a number of sustainability challenges, some of which are elaborated upon below:

- **Organic materials** that go to landfill are a substantial sustainability challenge as anaerobic decomposition results in the production of methane gas (SO2) contributing to climate change. In 2003, HRM collected 41,000 tonnes of organic materials from households. In addition, HRM has programs to collect Christmas trees and grass clippings. 5,000 tonnes of backyard compostables are collected by HRM each year. These organic materials are diverted from landfill and sent to one of two composting facilities, where they are turned into saleable compost. Currently, HRM is not separating compost in its internal corporate buildings and facilities[26], and is potentially missing an opportunity to demonstrate leadership to the rest of the community.

- **Batteries** that enter into the waste stream can lead to an increase in the concentration of trace metals in nature (SO1). For example, many batteries contain lead and cadmium that do not exist in large concentrations in nature. To manage this flow of rechargeable batteries, HRM partners with an organization called the *Rechargeable Battery Recycling Corporation* (RBRC) to take them back and recycle them in order to divert them from landfill.

- In 2003, HRM received 500 tonnes of household hazardous materials including cleaners, pesticides, gasoline, oil, solvents, and leftover paints. **Household chemicals**

[26] Internal operations are managed through the Real Properties and Asset Management (RPAM) department of HRM. For more information please refer to the *Maintenance and Operations* appendix of this report.

contain a number of substances that are foreign to nature (SO2) and trace metals (SO1) that can increase in concentration rapidly due to human-made flows of these substances. For example, paints may include trace metals as dyes (e.g. cadmium for red) and persistent chemical compounds (e.g. volatile organic compounds[27] as solvents). When these are discharged into water systems, they can increase quickly in concentration leading to poor water quality and death of aquatic wildlife. HRM manages these household chemicals in its Household Hazardous Waste Facility if citizens drop them at certain depots. In the case of paints, they are used paints are used to make new paints.

- **Chloroflourocarbons (CFCs)** are commonly found in aerosol cans and are a chemical compound that is persistent in nature (SO2). Their systematic accumulation has resulted in the depletion of the ozone layer. There is a provincial regulation for the capture of CFCs, and HRM has a program where CFCs are captured and recycled at households, although this program is not available to businesses.

- In 2003, HRM received 56,477 tonnes of construction and demolition **building materials**. This is a large amount that speaks to the need to design buildings with material that are reusable and develop systems that facilitate their reuse. HRM has a by-law that states 60% of building materials must be recycled, although this sometimes means that materials not reused in buildings, and rather lower quality applications (e.g. 1500 tonnes wood to produce woodchips used in parks). A discussion of buildings and their sustainability impacts is discussed in the section on RPAM – Capital Projects.

II. In addition to the materials mentioned above, there are some other materials and products that offer opportunities for HRM to improve is already impressive materials management record. Two important materials streams that were mentioned in various meetings with HRM staff are identified below, along with a brief discussion of their associated sustainability challenges.

- No programs were identified to measure or divert the amount of **electronic equipment** waste discharged into landfill in Halifax. Although, HRM is awaiting policy from the Province of Nova Scotia, it is important to note it as a sustainability challenge since electronic equipment (EE) is an increasing concern for municipalities. EE contains trace metals (SO1), such as copper, lead and mercury that, due to their low concentration in nature, can quickly increase in concentration when electronic waste is introduced into the waste stream and subsequently into nature. In addition, EE may also contain persistent chemical compounds (SO2) that do not exist in nature and therefore can also increase in concentration rapidly. For example, brominated fire retardants are used in EE are not found in nature and are suspected of being detrimental to human health (SO4).

[27] Volatile organic compounds (VOCs) (SO2) are also a precursor to the formation of smog (i.e. the consequence of a systematic increase in concentration of VOCs hastens the creation of smog). Smog is a contributor to poor air quality and its human health problems (SO4).

- **Light bulbs** contain mercury (SO1), a metal found in low concentrations in nature and whose concentration can increase quickly due to human made flows, such as from light bulbs. High efficiency light bulbs contain even higher amounts of mercury.

III. The **dependence on landfills** as a form of materials management is a sustainability challenge in the long-run, because it will result in the ever expanding need to consume **land** for landfills and systematic encroachment into nature (SO3). Currently, HRM diverts 55% of collected materials from landfill, with the stated goal of 60%, leaving 45% of waste reaching landfill. Expanding landfills are also costly for the municipality. The Solid Waste department estimates that by diverting waste from landfill, HRM is saving $15 million in capital costs every three years. A dependence on landfills also contributes to an inefficient use of materials (SO4). In addition, landfills pose a potential human health hazard (SO4). For example, the Sackville landfill did not initially have any leachate treatment facilities for its first 10 years of operations, and 35 households had to be moved, resulting in $10 million dollars of compensation paid out by HRM. In addition to health issues, other citizen concerns with landfills near their homes deal with pests, noise, and smells (SO4).

IV. The Solid Waste department is a heavy consumer of **energy**, directly through its facilities and a small fleet of vehicles, and indirectly through contractors' collection vehicles. HRM holds 11 contracts with collection companies, with estimated 64 vehicles used weekly to collect household waste from 120,000 homes.

- The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects.

- The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

Transition Guidelines

Making this shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from Solid Waste are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From a solid waste system that…	To a solid waste system that…
3 and 4	**Discharges materials and products as solid waste after use.**	**Keeps materials and products "in the loop" by re-use, recycling or manufacturer's extended responsibility.**
HRM has numerous initiatives supporting this transition and below are only two examples. Achieving a sustainable society where all materials are reused in either technical or natural cycles will require expanding the current list of items recycled and ensuring that materials are not used for lower quality applications (e.g. wood from buildings as wood chips instead of building materials). Beyond the list below, HRM also has programs to address batteries, household chemicals, and CFCs in aerosol cans (mentioned in the *Current Reality* section). <u>A Step in the Transition: Blue Bags and Recycling Facilities</u> HRM's blue bag collection program and recycling facilities enable households and businesses to manage their materials in a more sustainable manner. Recycling facilities keep products in *technical cycles* and allow a wide range of useful materials to be reused. For example, the collection of pop cans enables the reuse of aluminum, and the collection of batteries enable the reuse of trace metals such as nickel and cadmium. Trace metals are a particular concern because they do not exist in large concentrations in nature, and therefore the introduction of a large flow of batteries may rapidly increase this concentration. Currently, 55% of waste collected is diverted from landfill; ideally, 100% of materials would be diverted and reused as inputs into new products or nutrients in natural systems. <u>A Step in the Transition: Green Carts and Composting Facilities</u> Whereas recycling facilities keep materials in tight technical cycles, organic material collection systems and composting facilities keep organic materials within natural cycles, rather than discharging them into landfill to form methane gas. Green Carts are distributed to all homes in HRM to collect organic food waste, yard waste, cardboard and wood waste. By separating out this waste stream, HRM is able to produce compost. Compost also indirectly addresses another sustainability challenge if used as a substitute for fertilizers. The use of fertilizers contributes an overabundance of nutrients (SO3) in water systems and can cause a phenomenon known as eutrophication[28].		
1	**Uses non-renewable energy sources (such as gasoline for engines or coal-produced electricity for equipment)**	**Uses renewable energy sources, such as solar, geothermal, wind or bio-fuels.**
1	**Uses low efficiency buildings and vehicles.**	**Uses high efficiency buildings and vehicles.**

[28] Eutrophicatoin is when an overabundance of nutrients leads to a rapid grow of algae that consumes oxygen, leaving aquatic wildlife to "suffocate".

A Step in the Transition: Requirements for New Vehicles In contracts with companies that collect household waste, HRM has a requirement that no more than 20% of vehicles are 10 years or older. Although this requirement was not formulated with the reduction of carbon emissions in mind (increased reliability was the key), it does have this benefit because older vehicles tend to be less fuel efficient. No other requirements to address sustainability challenges were included, and there may be opportunities to include these types of requirements in the future.		
1 and 2	**Receives streams of scarce metals (cadmium, mercury lead), synthetic and non-renewable materials (such as petroleum products – e.g. nylon, polyester, etc.)**	**Receives streams of natural, sustainably harvested materials, and abundant metals.**
A Step in the Transition: Pre-Cycling Program The types and quantity of products that consumers purchase are an important determinant of the types and quality of materials that enter the waste stream. For example, some products may contain scarce metals, persistent chemical compounds, or high volumes of packaging. In addition, some products may be designed for recycling or durability that reduce their introduction into the waste stream. Pre-cycling is the idea of incorporating into purchasing decisions criteria to reduce waste, as opposed to only considering it at the end of the products' life. HRM's Pre-cycling program is an education program that attempts to reduce the amount of waste entering the waste stream by encouraging people to purchase goods that are more durable, have less packaging and are made with recycled materials.		
3	**Relies on intensive use of water.**	**Conserves water.**
4	**Uses products produced with low efficiency product development processes from remote locations.**	**Uses products produced with high efficiency product development processes primarily from regional and local locations.**
4	**Gives no consideration to labour standards or human rights where the products were manufactured.**	**Considers people's basic needs elsewhere by including labour standards and human rights in the places where the products were manufactured (e.g. "fair trade" coffee).**

Appendix V: Water Supply

Overview

The Halifax Regional Water Commission is a public utility owned by the HRM and responsible for the supply of municipal water to residents and businesses of the HRM. This involves protecting the water supply through watershed management, operating pumping stations, treatment facilities, reservoirs and the distribution network, and continuous monitoring and testing of water quality.

The Commission operates 2 large water supply production plants and 8 smaller systems, 16 storage reservoirs, 1200 km in water mains, 18 distribution pumping stations, 1635 sprinklers, more than 72,000 water meters, and 3 operations facilities. It is currently building a new administration and operations building. The water supply production plants at Lake Major and Pockwock Lake are both managed using an ISO 14001 certified environmental management system. They are the first two water plants in Atlantic Canada to receive this certification.

The Commission is also one of the most significant landowners in the HRM. It owns more than 5,000 ha of land in the watersheds of its two main water sources, Lake Major and Pockwock Lake, and other backup sources. Further land acquisition is an ongoing part of its capital program and represents about 5% of the Commission's annual capital budget.

The Commission serves a population of more than 310,000 people. Metered water sales to customers account for about 74% of the Commission's revenues, which totaled about $31 million in 2003. In addition to water supply, the Commission provides fire protection services for the HRM, accounting for about 24% of revenue, though more than 7500 water hydrants. Additional services provided by the Commission include leak detection services and water consumption monitoring for private customers, leasing land to telecommunication companies, and the provision of water conservation devices to customers.

Sustainability Objectives

In a sustainable future, potable water must be supplied to the residents and businesses of the HRM through a water supply system that achieves the acha four Sustainability Objectives[29], which are to:

SO1) …eliminate the contribution of the water supply system to systematic increases in concentrations of substances from the earth's crust;

[29] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer the section called "The Natural Step Framework".

SO2) …eliminate the contribution of the water supply system to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of the water supply system to systematic physical degradation of nature;

SO4) …eliminate the contribution of the water supply system to the undermining of people's ability to meet their needs.

Current Reality

Clean, safe potable water is essential for the health and quality of life of the HRM's citizens (SO4) and for the regional economy. It is therefore fundamental to sustainability. How the water is supplied also affects the impact of the HRM on sustainability. Some of the major sustainability impacts of HRM's water supply system are identified and elaborated upon below:

1. The Lake Major and Pockwock Lake watersheds are designated as **protected areas** under the Nova Scotia Environment Act. More than 90% of the land within the watersheds is owned by the Halifax Regional Water Commission or the Province of Nova Scotia. Its goal is to own 95% of the land in the watersheds with priority to shoreline acquisitions. The Commission seeks ownership of the land in the watersheds to preserve it from development in order to control the quality of its water supply. One of the effects of this approach is that it prevents the physical degradation of nature (SO3) in a large amount of land in the HRM.

   The water supply production plants at Lake Major and Pockwock Lake feature **dams**. Damming has the potential to alter ecosystems and habitat (SO3) by changing the natural flow and flood of a water system.

   The Commission owns some land in the city as well, where its reservoirs and facilities are located. These sites are all in existing developments and therefore do not make any significant contributions to further expansion into natural areas (SO3). However, a continuous expansion of new developments in the HRM is accompanied by an expansion of the water supply infrastructure and represents a sustainability challenge since it results in a systematic encroachment into natural areas (SO3). Research for HRM's Regional Plan revealed that more than 50% of new developments in the HRM take place in unserviced areas. In general, however, this challenge is more associated with Regional Planning than with the provision of water. Such land use issues are discussed in more detail in the appendix titled *Land Use and Transportation*.

2. The Commission is a large consumer of **energy** through its pumping stations, facilities, vehicles, equipment, and backup power generators. Energy is primarily consumed in the form of fossil fuels, either through oils for space heating, coal for

electricity[30], or gasoline and diesel for mobility, backup power, and equipment. The Commission spends approximately $1.5 million per year on electricity.

- The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity), *diesel* (backup power) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. For example, vehicles are used to go from household to household to read water meters. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects.

- The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

- The *transportation of input products and materials* contributes to systematic increases to the impacts associated with fossil fuels. This is particularly true if products are transported over large distances from the manufacturer to HRM, which is the case for many of the Commission's materials. Most of the chemicals used in the treatment process come to the HRM via tankers, and chlorine gas comes via trucks in one tonne cylinders. The mode of transportation affects the degree of these impacts. For example, transportation by train is more fuel-efficient than transportation by truck, and has fewer sustainability challenges associated with fossil fuels.

3. Many of the **chemicals** and substances used in the water treatment process have the potential to systematically accumulate in nature, especially if they are persistent compounds (those that do not breakdown easily). Some of The Commissionthese substances are described below.

- *Chlorine* is added as a disinfectant. Although chlorine gas is not a human-made substance, it introduces two primary potential sustainability challenges. Chlorine gas is a pulmonary irritant with intermediate water solubility that causes acute damage in the upper and lower respiratory tract of humans. It has even been used as a chemical weapon, for example during World War One. The risk of an accidental release of chlorine gas, either during cylinder transfers or from valve/equipment failure, is therefore a potential security concern (SO4) that must be managed. In addition, when chlorine combines with organic materials in sewer systems, they form chlorinated organic compounds such as trihalomethanes (THMs). Some of these substances are suspected of being carcinogenic (SO4). Accordingly, limits are established by Health Canada for maximum acceptable concentrations in drinking water.

[30] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

- *Potassium Permanganate* is a chemical used to oxidize iron and manganese, as well as to help reduce THM levels (see above). It is considered a hazardous material because it is an oxidizing agent that can react with certain reducing agents and generate heat. It therefore must be handled carefully to limit human health risks (SO4).

- *Aluminum Sulfate (alum)* is a substance consisting of a double sulfate of aluminum and potassium that is used as a coagulant to lump together silt, bacteria and other solids and impurities in the water treatment process. It therefore ends up as alum sludge that creates sustainability challenges, depending on how the sludge is managed. If it is disposed of as solid waste, it contributes to the sustainability challenges of landfills (SO1, SO3). If it is released into lagoons or natural areas, it can disrupt ecosystems (SO3) and systematically increase in concentration (SO2). The sludge can, however, be reprocessed to reclaim the alum for re-use.

4. The Commission depends on a number of **other materials** to deliver clean water to HRM residents. The way that materials are managed affects the degree to which they contribute to sustainability challenges. While some of the materials used are of relatively minor importance in terms of their sustainability impacts, a few select materials and their sustainability challenges are listed below.

    - **Pipes** are the key material in the distribution network infrastructure that takes treated water from the water supply plants to homes and businesses throughout the HRM. In the HRM, the majority of piping is made from **ductile iron**, while **concrete** and **polyvinyl chloride (PVC)** are also used. Each of these piping materials has some sustainability challenges associated with it. For example, the manufacturing process for all of them are very energy intensive and depend on a variety of chemicals, metals and minerals. In addition, the ultimate fate of the pipes is of concern. While some pipes stay in the ground, others are removed. If the materials are not kept in tight technical cycles, they can contribute to the various sustainability challenges associated with waste disposal techniques such as landfills or incineration. PVC is of particular concern if it is incinerated, as it leads to the creation of dioxins, furans and organochlorine substances, all of which are persistent (SO2) and have negative human health effects (SO4).

    - The Commission maintains a series of buildings and facilities, and is constructing a new headquarters building, all of which involves the use of a wide range of **building materials**. For more information on building materials, please refer to the appendices on *Capital Projects* and *Maintenance and Operations*.

    - The Commission owns and maintains a fleet of more than 50 **vehicles**. For materials associated with vehicle maintenance (coolants, oils and lubricants, tires, batteries), please see the appendix on *Fleet Management*.

Transition Guidelines

Making a shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In

addition, some current initiatives of the Commission are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From a Water Supply system that…	To a Water Supply system that…
4	**Risks public health in the delivery of water to citizens by allowing opportunities for contamination or security breaches.**	**Protects public health by delivering safe and high quality water to citizens.**
A Step in the Transition: Multiple Barrier Approach The Commission utilizes a multiple barrier approach to maintain delivery of safe and high quality water. This approach features a series of checks and balances from the watershed to the customer's tap and is considered best practice within the water quality profession to ensure public health protection. The multiple barriers include source protection, optimization of the treatment process, sound distribution system management, cross connection control, and continuous monitoring and testing. The HRM's water consistently ranks among the highest quality in North American cities.		
3	**Relies heavily on treating the water to improve water quality, rather than protecting it at the source.**	**Protects the water supply at the source *(quality in – quality out)***
A Step in the Transition: Watershed Management Plan The Commission has an aggressive watershed management plan that involves purchasing and protecting as much as land as possible in the watersheds of Lake Major and Pockwock Lake, as well as consulting with numerous stakeholders through active watershed advisory committees. The Commission has a full-time staff person designated as Watershed Manager.		
2	**Uses treatment methods and substances that result in an accumulation of persistent compounds and/or waste**	**Uses treatment methods and substances that result in no accumulation of persistent compounds or other waste**
1	**Uses non-renewable energy sources (such as fossil fuels) for pumping, heating, lighting and transportation.**	**Uses renewable energy sources, such as solar, geothermal, wind or bio-fuels.**
1	**Wastes energy, relying on low-efficiency energy uses during pumping and treatment, and low-efficiency buildings and vehicles.**	**Conserves energy, using energy efficient facility design, construction and operations, and fuel-efficient vehicles.**

1 and 3	**Uses non-renewable materials in buildings and infrastructure**	**Uses sustainably-harvested renewable materials in buildings and infrastructure**
1 and 2	**Uses scarce metals and synthetic materials in buildings and infrastructure such that they accumulate in nature**	**Uses abundant metals and non-persistent compounds in materials in buildings and infrastructure or ensures that scarce metals and synthetic materials are recaptured and kept in tight technical cycles.**
3	**Withdraws excessive amounts of water from surface and groundwater sources.**	**Employs water conserving methods and policies to meet water use needs most efficiently.**
A Step in the Transition: Metering The HRM is fully metred and has a full-cost recovery pricing structure for its water. The rates are set by the Nova Scotia Regulator and Review Board. In the past 3 years, they have been increased by 25% due to increases in operating expenses, new infrastructure investments, and expenses associated with financing and depreciation of assets. A Step in the Transition: Infrastructure Leakage Index The Commission was the first North American utility to adopt the International Water Association approach to infrastructure leakage. This has resulted in over 6 million gallons per day in water savings – or a decrease from 25% to 15% since 1996 in the percentage of water that does not reach the customer due to leaks. In fact, although the Commission's customer base increases by about 1,000 customers per year, there has been a net overall decrease in demand, due to leakage repairs. They are currently operating at break-even financially with respect to infrastructure leakage repair (i.e. almost spending more on leakage repairs than they save in water). This has the additional advantage of lowering risks associated with litigation. A Step in the Transition: Conservation Partnerships The Commission has established partnerships with Clean Nova Scotia and The Eco-Efficiency Centre, which are two organizations that promote efficiency measures with residents and businesses respectively. The Commission provides financial contributions, expertise and water conservation devices to help these organizations with their promotions, home tune ups and retrofits.		
4	**Uses materials and products produced with low efficiency product development processes from remote locations.**	**Uses materials and products produced with high efficiency product development processes primarily from regional and local locations.**
4	**Gives no consideration to labour standards or human rights where the materials and products were manufactured.**	**Considers people's basic needs elsewhere by including labour standards and human rights in the places where materials and products were manufactured (e.g. "fair trade" coffee).**
1,2,3,4	**Includes distribution infrastructure that is dispersed across a wide area,**	**Utilizes an efficient, compact design resulting in efficient use of material,**

	using excessive amounts of materials and land and contributing to a more costly system per capita.	**land and energy (and saving money).**

Appendix VI: Wastewater

(This appendix was written based on an initial consultation with HRM staff, however due to time constraints relating to scheduling problems, the text has not been formally reviewed by HRM staff, as with the other appendices.)

Overview

Wastewater management in the HRM is very high on the public and political agenda, mainly due to the fact that the Halifax Harbour, one of the best deepwater, ice-free ports in the world and a major part of economic activity and community life in the HRM, is polluted by over **181 million litres per day** of untreated water, both sanitary and storm wastewater.

Halifax Regional Municipality currently owns and operates a total of 12 sewage treatment plants, a landfill leachate facility, a domestic water plant, a sludge transport unit and a biosolids stabilization lagoon. The total process capacity of all existing HRM sewage treatment facilities is approximately **58 million litres per day**. The HRM wastewater treatment plants incorporate a large diversity of treatment technologies ranging from established methods such as extended aeration and trickling filters to hybrid anaerobic reactors, rotating biological contactors, pure oxygen systems and engineered marshland disposal. Operation and maintenance of the HRM facilities is performed by the Wastewater Treatment Division of the Environmental Management Services department. Nevertheless, the vast majority of wastewater continues to flow into the Halifax Harbour.

Many attempts have been made during the past decades to implement a Halifax Harbour solution, but only now are the citizens of the Halifax Region finally seeing a strategy implemented. Halifax Regional Council is proceeding with the Halifax **Harbour Solutions Project**, designed to eliminate the flow of raw sewage and other contaminants into the Halifax Harbour.

The Harbour Solutions Project calls for completion of the Halifax Harbour collection systems and the construction of three new advanced primary treatment[31] plants: a) at Cornwallis Street/Lower Water Street area in Halifax; b) in the Dartmouth Cove/Sandy Cove area; and c) at Herring Cove. On June 15, 2004, the HRM officially signed

[31] Primary treatment involves mechanical processes that remove much of the floating and suspended solid material in the wastewater. ***Advanced primary treatment*** removes up to 70% of the suspended solids in wastewater and improves upon primary treatment by adding chemicals as flocculants to the settling process. The final stage of the treatment process is the disinfection of the effluent before it is released into the harbour. The HRM will use UV disinfection, rather than chlorination. The 3 new plants will be constructed such that they can be upgraded from advanced primary to secondary or tertiary treatment by the HRM in the future if it is deemed necessary.

agreements for the design, construction and commissioning of the three sewage treatment plants for a guaranteed maximum price of $133.2 million (plus flow through costs of bonding, insurance, applicable taxes and inflation). In total, the Harbour Solutions Project is expected to involve a capital investment of $333 million.

Sustainability Objectives

In a sustainable future, wastewater must be managed in the HRM through a system that achieves the acha four Sustainability Objectives, which are to:

SO1) …eliminate the contribution of the wastewater system to systematic increases in concentrations of substances from the earth's crust;

SO2) …eliminate the contribution of the wastewater system to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of the wastewater system to systematic physical degradation of nature;

SO4) …eliminate the contribution of the wastewater system to the undermining of people's ability to meet their needs.

Current Reality

In general, wastewater is collected and discharged and/or treated in order to protect public health (SO4). It is therefore fundamental to sustainability. How the wastewater is handled also affects the impact of the HRM on sustainability. Some of the major sustainability impacts of HRM's water supply system are identified and elaborated upon below:

1. The main sustainability impacts of the current wastewater management system in the HRM are obviously related to the **discharge of wastewater into the Halifax Harbour**. Numerous studies have been performed to evaluate the state of the Halifax Harbour and the effects of pollutants discharged to the harbour through untreated sanitary, storm and combined sewer outfalls. The most important of these impacts are described below. Many of them will be reduced or eliminated through the implementation of the Harbour Solutions Project, nevertheless they must be mentioned in this analysis, given that the impacts are significant today and will be during the time that the Harbour Solutions Project is implemented.

    - In general nature (receiving waters) can only accept small amounts of sewage before becoming polluted, because natural bacteria feed on the sewage organics and create an abnormal amount of dissolved oxygen uptake. Dissolved oxygen, which exists in minute amounts, is required by all marine life for survival. Therefore, one of the primary impacts of discharging raw sewage into the Halifax Harbour is its negative effect on **marine life** (SO3). Studies have clearly demonstrated that bacterial contamination in the Halifax Harbour is widespread. One of the principle objectives of wastewater treatment is to prevent as much of this "oxygen-demanding" organic material

as possible from entering the receiving water. Treatment facilities compress the organic decomposition processes that take place in nature through a combination of physical, biological, and chemical treatment stages.

- The wastewater that is discharged into the harbour also contains trace amounts of scarce metals (SO1), excessive nutrients (SO1), persistent chemical compounds such as pesticides and pharmaceuticals (SO2), and other garbage including objectionable items (SO4). These substances reach the harbour through a combination of what is flushed down the drains and toilets in homes and businesses around the HRM, what is deposited directly in storm drains as litter, as well as what enters the sewage drainage system when stormwater washes substances of roadways and other surfaces. Studies show that large areas of **contaminated sediment** exist around some forty separate outfalls into the Halifax Harbour. Shellfish harvesting is prohibited in the harbour because of this contamination. Wastewater treatment also aims to remove such substances.

- **Water quality** is poor along the shorelines of the harbour, and **aesthetics** are also poor due to particulates, floatables and odour, all of which limits the number of uses for which the harbour can be used. For example, it seriously restricts the potential recreational and tourism uses of the harbour (SO4) and poses problems residents.

- All of these issues also have a detrimental affect on the **reputation of the HRM** in a general sense. The negative impact on the reputation of the HRM can carry economic impacts (SO4) for the region on top of the environmental impacts.

2. The sewage treatment process currently treating 58 million litres of wastewater per day and eventually treating the additional 181 million litres per day currently discharged in the harbour generates **sludge** – the mixture of materials and substances that is left over once it has been filtered out of the water. The sludge is primarily organic material with high nutrient content, but also contains scarce metals and chemicals as described above. In some municipalities, sewage sludge is taken to landfill or incinerated, which results in the numerous sustainability impacts associated with these two methods of waste disposal. For example, organic material in landfills generates methane (SO2), a major greenhouse gas, when it decomposes. Depending on landfills as a waste disposal method also creates an ever-increasing demand for land (SO3). The HRM has decided that, rather than landfilling or incinerating it, the material should be used for some beneficial purpose, as it tries to do for other waste streams such as municipal recyclable waste and compost. The HRM currently further processes the sludge in a biosolid stabilization lagoon, creating an output material that is sold as fertilizer. While this reduces the mass of biosolids, it may not eliminate the problem of a systematic build up of trace metals (SO1) and persistent compounds (SO2), since they can still accumulate in the lagoon.

3. The wastewater management system consumes **energy** through pumps, facilities, vehicles, equipment, and backup power generators. Energy is primarily consumed in

the form of electricity[32], for the ultraviolet (UV) disinfection process, pumping and general operation of facilities. Other energy sources include oils for space heating in facilities, and gasoline and diesel for mobility, backup power, and equipment. All of these will increase during construction of new facilities and infrastructure.

- The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity), *diesel* (backup power) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects.

- The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

- The *transportation of input materials and output sludge* contributes to systematic increases to the impacts associated with fossil fuels. This is particularly true if materials are transported over large distances from manufacturers to the HRM or from treatment plants to waste disposal sites. HRM currently operates and maintains a 5,000 gallon tractor-trailer unit for the purpose of transporting treated biosolids (sludge) from HRM treatment plants to the biosolid stabilization lagoon. The mode of transportation affects the degree of these impacts. For example, transportation by train is more fuel-efficient than transportation by truck and has fewer sustainability challenges associated with fossil fuels.

4. Many of the **chemicals** and substances used in the water treatment process have the potential to systematically accumulate in nature, especially if they are persistent compounds (those that do not breakdown easily). Some of The Commissionthese substances are described in detail in the Appendix on Water Supply, and one of them is elaborated upon below.

- Although the advanced primary treatment process in the 3 new treatment plants will use ultraviolet (UV) disinfection, the existing treatment plants use *chlorine* as a disinfectant. Chlorine gas is not a human-made substance, but it introduces two primary potential sustainability challenges. Chlorine gas is a pulmonary irritant with intermediate water solubility that causes acute damage in the upper and lower respiratory tract of humans. It has even been used as a chemical weapon, for example during World War One. The risk of an accidental release of chlorine gas, either during cylinder transfers or from valve/equipment failure, is therefore a potential security concern (SO4) that must be managed. In addition, when chlorine combines

[32] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

with organic materials in sewer systems, they form chlorinated organic compounds such as trihalomethanes (THMs). Some of these substances are suspected of being carcinogenic (SO4). Accordingly, limits are established by Health Canada for maximum acceptable concentrations in drinking water.

5. The HRM's treatment facilities occupy land both in existing developed areas and in more remote natural areas. These sites do not make a significant contribution to further expansion into natural areas (SO3). However, a continuous expansion of new developments in the HRM is accompanied by an expansion of the **wastewater infrastructure** and represents a sustainability challenge since it results in a systematic encroachment into natural areas (SO3). In general, however, this challenge is more associated with Regional Planning than with the provision of water. Such land use issues are discussed in more detail in the section of this report on Regional Planning.

6. Environmental Management Services depends on a number of **other materials** to handle the HRM's wastewater. The way that materials are managed affects the degree to which they contribute to sustainability challenges. While some of the materials used are of relatively minor importance in terms of their sustainability impacts, a few select materials and their sustainability challenges are listed below.

    - **Pipes** are the key material in the distribution network infrastructure that takes treated water from the water supply plants to homes and businesses throughout the HRM. In the HRM, the majority of piping is made from **ductile iron**, **concrete,** and **polyvinyl chloride (PVC)**. Each of these materials has some sustainability challenges associated with it. For example, the manufacturing process for all of them are very energy intensive and depend on a variety of chemicals, metals and minerals (SO1,2). In addition, the ultimate fate of the pipes is of concern. While some pipes stay in the ground, others are removed. If the materials are not kept in tight technical cycles, they can contribute to the various sustainability challenges associated with waste disposal techniques such as landfills or incineration. PVC is of particular concern if it is incinerated, as it leads to the creation of dioxins, furans and organochlorine substances, all of which are persistent (SO2) and have negative human health effects (SO4).

    - The wastewater system also relies on other pieces of equipment, such as pumps and the machinery used in the treatment plants. This equipment has a limited life span, and must be replaced or repaired at various intervals. If a piece of equipment is replaced, the old piece of equipment often goes to landfill, contributing to a continued physical degradation of nature (SO3) and possibly to increased concentrations of metals (SO1) or persistent compounds (SO2), depending on what is in the particular piece of equipment.

    - Environmental Management Services uses a series of buildings and facilities, all of which involves the use of a wide range of **building materials**. For more information on building materials, please refer to the sections of this report on *Capital Project* and *Facilities – Operations*.

- Environmental Management Services uses **vehicles** for transportation. For materials associated with vehicle maintenance (coolants, oils and lubricants, tires, batteries), please see the section of this report on *Fleet Management*.

Transition Guidelines

Making a shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives of the Commission are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From a Wastewater system that…	To a Wastewater system that…
4	**Risks public health in the handling of wastewater by allowing opportunities for leakages.**	**Protects public health by handling wastewater safely.**
4	**Contaminates Halifax Harbour or other downstream waters, preventing others' use.**	**Creates no obstacles to other people's use of Halifax Harbour or water in general.**
A Step in the Transition: Harbour Solutions Project The Harbour Solutions Project is described in the overview of this section. As a whole, it consists of four key components: 1. Sewage Collection System, including outfalls, diffusers and access roads 2. Design and Construction of 3 new Sewage Treatment Plants 3. Operation of Sewage Treatment Plants 4. Biosolids (sludge) management Implementing the Harbour Solutions Project will ensure that the many problems associated with the discharge of sewage into the harbour (all SCs) are significantly reduced.		
1,2	**Discharges excessive amounts of effluent contaminants (e.g. trace metals, nutrients, chemicals) into Halifax Harbour or other downstream waters, resulting in systematic accumulation in the environment.**	**Discharges at a rate not exceeding the natural system's ability to absorb.**

A Step in the Transition: Pollution Prevention (Source Control) Program In addition to treating the wastewater to ensure that contaminants do not enter the harbour, the contaminants can be stopped from entering the wastewater in the first place. As part of the Harbour Solutions Program, the HRM has initiated a Source Control Strategy, now referred to as the Pollution Prevention (P2) Program, aimed at reducing the levels of nutrients, metals and toxins currently entering the wastewater system and, ultimately, the Halifax Harbour. In July of 2001, HRM put in place the Wastewater Discharge By-Law (W-101) which regulates the discharge of specified substances and concentrations, such as, paints, solvents and other hazardous, metal-rich and toxic products and wastes. The Pollution Prevention (P2) Program enforces compliance with the Wastewater Discharge By-Law through planning, education, inspections, and monitoring at the source of these discharges. The P2 Program is an on-going operational activity of HRM.		
2,3	**Depends on landfill or incineration as a waste disposal method for the biosolids removed from the water**	**Generates safe fertilizer from the biosolids removed from the water**
A Step in the Transition: Biosolids as fertilizer The HRM has recently obtained approval under the Canadian Environmental Assessment Act to process the biosolids into a soil amendment/fertilizer product, using a lime stabilization process. The final product must meet USEPA Class A standards for biosolids products, and also meet the Canadian Food Inspection Agency requirements under the Canadian fertilizer Act, for labeling as a fertilizer product for sale in Canada. A facility to manufacture this biosolids product will be built in the HRM as part of the Harbour Solutions Project. It will be owned by the HRM. The product will be marketed for appropriate uses under all applicable federal and provincial regulations.		
2	**Uses treatment methods and substances that result in an accumulation of persistent compounds and/or waste (i.e. sludge) in landfills**	**Uses treatment methods and substances that result in no accumulation of persistent compounds or other waste**
1	**Uses non-renewable energy sources (such as fossil fuels) for pumping, heating, lighting and transportation.**	**Uses renewable energy sources, such as solar, geothermal, wind or bio-fuels.**
1	**Wastes energy, relying on low-efficiency energy uses during pumping and treatment, and low-efficiency buildings and vehicles.**	**Conserves energy, using energy efficient facility design, construction and operations, and fuel-efficient vehicles.**
1 and 3	**Uses non-renewable materials in buildings, equipment and infrastructure**	**Uses sustainably-harvested renewable materials in buildings and infrastructure**
1 and 2	**Uses scarce metals and synthetic materials in buildings, equipment and infrastructure such that they accumulate in nature**	**Uses abundant metals and non-persistent compounds in materials in buildings, equipment and infrastructure or ensures that scarce metals and synthetic materials are recaptured and kept**

		in tight technical cycles.
4	**Uses materials, equipment and products produced with low efficiency product development processes from remote locations.**	**Uses materials, equipment and products produced with high efficiency product development processes primarily from regional and local locations.**
4	**Gives no consideration to labour standards or human rights where the materials, equipment and products were manufactured.**	**Considers people's basic needs elsewhere by including labour standards and human rights in the places where materials, equipment and products were manufactured (e.g. "fair trade" coffee).**
1,2,3,4	**Includes collection infrastructure that is dispersed across a wide area, using excessive amounts of materials and land and contributing to a more costly system per capita.**	**Utilizes an efficient, compact design resulting in efficient use of material, land and energy (and saving money).**

Appendix VII: Capital Projects

Overview

Capital Projects is a division within Real Property and Asset Management (RPAM) and is responsible for the planning, development, and delivery of Halifax Regional Municipality's Capital Building Program, which includes capital projects for all buildings, parks and parkland, and business parks as well as the delivery of capital work required in support of HRM's corporate initiatives. Each year HRM spends $20 million on capital projects. Most staff people in the Capital Projects are project managers, and their responsibilities are focused in the following areas:

- Identification and programming of capital and facility maintenance deficiencies
- Prioritization of requirements
- Coordination of design / tender process
- Project and construction management

HRM owns 300+ buildings and 2 million sq.ft.of building space on 8000 acres of land. Fewer than 100 buildings are either leased, or are on hold pending their sale or disposal. The rest are used by HRM for municipal purposes. These include office buildings, libraries, fire stations, recreation centres, baseball diamonds and others. Capital Projectsalso coordinates capital repairs for buildings and parks after the Hurricane Juan disaster recovery.

Please note that a separate appendix of this report, *Maintenance and Operations*, speaks specifically to building maintenance, while this appendix focuses on capital projects.

Sustainability Objectives

Sustainable capital projects in the future will ultimately construct and manage buildings while achieving the acha four Sustainability Objectives[33], which are to:

SO1) …eliminate the contribution of buildings to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of buildings to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of buildings to systematic physical degradation of nature;

[33] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to the sectioned called *The Natural Step Framework*.

SO4) …eliminate the contribution of buildings to undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of buildings in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

1. The buildings that RPAM leases and owns are heavy consumers of **energy**. In addition the vehicles and equipment used by contractors to construct buildings consumes large amounts of energy. Currently, energy is primarily consumed in the form of fossil fuels, either through oils for space heating, coal for electricity[34], or gasoline and diesel for mobility.

- The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon (SO1), sulfur (SO1), trace metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of the above substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects (SO4). For example, HRM buildings cause an estimated 60,000 tonnes of CO_2 equivalents in emissions.

- The use of fossil fuels also results in a number of indirect impacts generated from the *production of fossil fuels*. These include systematic physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

    - The *transportation of building materials* supplied to Capital Projects also contributes to systematic increases to the impacts associated with fossil fuels, especially if products are transported over large distances from the manufacturer to HRM. It was estimated that 80% of building materials used in HRM buildings are transported from outside of the Halifax region. The mode of transportation also affects the degree of these impacts. For example, transportation by train is more fuel-efficient than transportation by train, and has fewer sustainability challenges associated with fossil fuels.

2. Capital Projects is a large consumer of **building material**s through its contractors. Each building material has it own unique properties, is produced differently, contains different raw materials, is used for different purposes and disposed of in

[34] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

different ways. As a result, different sustainability challenges arise from differences in where the building material is procured and how it is managed after it is used in a building. Due to the large amount of materials that Capital Projects purchases, the management of these materials leads to many sustainability challenges. *Currently, an opportunity exists for Capital Projects to incorporate policies and/or criteria based on sustainability principles into their request for proposals and competitive evaluation process*. A full discussion of all building materials and their associated sustainability challenges is beyond the scope of this analysis, however, a few select materials and their sustainability challenges are elaborated upon below. Please also refer to the *Current Reality* discussion in the Procurement appendix for a general discussion of products and sustainability impacts. Since materials are purchased mostly through contractors, HRM does not track the amount or type of materials used in capital projects. Therefore, no numbers are available for the following materials.

- *Steel and other metals are* an important component of buildings, providing both structure and aesthetics.
    - The sustainability challenges associated with steel, and other metals, deal primarily the energy used in the production process (SO1 and SO2) and the systematic physical encroachment into nature of mining practices (SO3). Since steel is one of the most recycled and reused materials , these sustainability challenges can be reduced through reuse of steel products from old buildings and, to a lesser extent, the recycling of the materials itself into new steel products.
    - In addition to the sustainability challenges associated with the production of metals, there is also a challenge of using building materials with *metals that are not abundant in nature* (SO1). For example, metals such as copper and chromium exist in low concentrations in nature, and therefore, societal flows of these metals in nature can rapidly increase their concentrations as they systematically accumulate. Higher concentrations of trace metals lead to many human health problems. This does not mean that these metals should not be used. It means that builders should try to procure metals that have already been extracted from the Earth's crust and use them again in new buildings. If this happens and they are continuously recycled, these metals will not systematically increase in nature.
- *Wood and Wood Products* are important components of buildings, providing both structure and aesthetics.
    - The sustainability challenges associated with wood products primarily concern the management of resources. For example, the use of wood, a renewable resource, may contribute to the systematic physical encroachment into nature in the form of deforestation (SO3) or promotion of less resilient monocultures (SO3) if wood is harvested from sources where sustainable forest management practices are not practiced. In

addition, some forestry companies may add synthetic herbicides and pesticides (SO2).

- *Wood products* may also contain trace metals (SO1) and persistent compounds (SO2). For example, to produce pressure-treated wood, wood is first bathed in preservative pressed into the wood using high pressure. A common preservative is CCA (chromated copper arsenate). Over time small amounts of chromium, copper and arsenic (SO1) leak out into the ground and ground water, or are released when the wood is burned. These metals are found in low concentrations in nature and therefore even small inputs can lead to systematic increases. Persistent compounds may also be present in wood products, in the form of formaldehyde in particleboard. Formaldehyde contributes to poor indoor air quality in buildings (SO4).

- *Polyvinyl chloride* (PVC) is used in buildings in piping to carry water and in window frames. PVC is a versatile plastic that forms an excellent barrier to water and gases, has mechanical strength, is lightweight, resistant to chemicals, non-combustible, and has electrical insulation properties.

  - PVC includes many persistent *chemical additives* that are foreign to nature to give it its unique properties (SO2). These include, for example, phthalates that provide rigidity. In the production process, additives may leak and systematically increase in nature causing environmental and human health effects (SO4). Other such compounds include dioxins, furans and CFCs.

  - PVC contains *trace metals* as stabilizers (SO1) to make it resistant to heat. This forms about 2-3% of the weight of PVC. Again, these trace metals may leak during the production process, and systematically increase in nature.

  - *Petroleum* is the main feedstock for PVC. Exploration and drilling practices for petroleum can contribute to the systematic degradation of nature by physical means (SO3), and should therefore be managed at the minimum level consistent with meeting human needs. Some companies restore or reclaim land after mining operations cease to reduce degradation, however they may contribute to indirect degradation through spills of chemicals (SO2) or mined trace metals (SO1) that are inadvertently released into nature.

- *Carpets* are used throughout HRM buildings to provide comfort and aesthetics. Carpets are an amalgamation of petroleum and a wide range of chemicals, many of which are volatile organic compounds (VOCs) (SO2) that increase in concentration indoors and lead to poor indoor air quality (SO4). In addition, VOCs are a precursor to the formation of smog and poor urban air quality (SO4).

- Many used building materials in the foreseeable future will be deposited in *landfill sites* or else incinerated. Although many landfill sites are already degraded

areas, this method of waste disposal nevertheless contributes in the long term to the loss of land area and quality (SO3). To reduce our dependence on landfills, materials can be diverted and recycled. For example, emerging processes reuse nylon in used carpets to produce new carpets. Please refer to the section on Solid Waste for a more detailed discussion of management of materials.

3. Buildings leased by Capital Projects are large consumers of **water** for cooling equipment and for cleaning and personal hygiene of occupants. Specific sustainability challenges leading from the production and consumption of water are covered in further detail in the section on *Water*. The design of buildings and the selection of appliances and products in a building has important implications on the quantity of water consumed.

4. HRM owns HRM owns 8,073 hectares of **land** of which 2611 hectares are parkland. Site selection affects the sustainability challenges associated with a particular building or facility. Development on green field sites or wetlands may lead to soil erosion and disruption of habitat (SO3). Further discussion on land use and sustainability challenges are found in the appendix on *Land Use and Transportation*.

Transition Guidelines

Making this shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from Capital Projects are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

To be able to achieve sustainable capital projects, it will be important to incorporate sustainability principles into the design of the buildings, as this will determine many of its sustainability challenges. There are many tools to support organizations in accomplishing this, such as the Leadership in Energy and Environmental Design (LEED) Program from the U.S. Green Building Council.

Sustainability Objective	From Capital Projects that…	To Capital Projects that…
1	**Use non-renewable energy sources (such as propane or natural gas-based systems) for heating and lighting**	**Use renewable energy systems, such as small hydroelectric, geo-thermal, solar, and wind.**
1	**Incorporate wasteful and low efficiency energy uses during housing construction and operations**	**Incorporate energy conservation and efficiency through housing design, construction and operations**

1 and 2	**Use scarce metals and synthetic materials during construction and operation (e.g. cadmium, mercury, lead, VOCs in carpets, etc.)**	**Prioritize use of reused, recycled or renewable materials, followed by abundant metals as a second choice (iron, aluminum, silica)**
1, 2, 3, and 4	**Are widely dispersed and accessible only by private vehicles, thereby requiring extensive roads, parking and utility corridors (e.g. clearings for sewer mains)**	**Are relatively compact and within walking distance to services and transit.**
3	**Physically degrade natural areas in a systematic manner (e.g. by causing an accumulating degradation of local habitat)**	**Cause no net degradation of natural systems by targeting already disturbed sites.** ***Note: This may not be possible or desirable for other reasons in the short term but is necessary in the longer term.***
3	**Use unsustainably harvested building materials (e.g. wood products from harvested old growth forests)**	**Use materials that are sustainably harvested and have met certification standards, such as those established by the Forest Stewardship Council**
3	**Require an intensive use of water for domestic and landscape uses**	**Conserve water through design and operations**
4	**Through building designs, construction and operations that are wasteful in their material and energy use**	**Use designs and practices that are efficient with regards to use of energy**

A Step in the Transition: Energy Efficiency Pilot Projects

HRM is registered to the Federation of Canadian Municipalities Partners for Climate Protection (PCP), and has established a target of a 20% reduction in carbon emissions. Recently an energy efficiency expert was hired to review opportunities in buildings to reduce energy use. Currently, there are two pilot projects to test different approaches to achieving energy savings. One involves hiring an energy savings company (ESCO) to implement energy efficiency improvements on the garage for transit vehicles, which is the largest single consumer of energy in the HRM building stock. The second involves HRM itself making renovations on a 25,000 sq ft. library, including the installation of light tubes, new pumps and high-efficiency motors. The expected outcome of both projects to generate enough future cash flow to support future investments and reduce carbon emissions.

Appendix VIII: Maintenance and Operations

Overview

The Operations area of Real Property and Asset Management (RPAM) is responsible for the maintenance of over 300 buildings and 2 million square feet of building space owned by Halifax Regional Municipality (HRM), office buildings, swimming pools, arenas, and ballparks. The annual budget for building operations is approximately $20 million.

The services Operations provides to other departments include custodial services, landscaping, snow removal, replacement of glass and roofing, repair of escalators and elevators, maintenance of lights, inspection of buildings, amongst others. To provide the services mentioned above, the RPAM also uses a number of buildings, vehicles, and equipment.

Please not that there are separate appendices that discuss Capital Projects, and Parks and Open Spaces. This appendix will primarily focus on building operations.

Sustainable Building Operations

A sustainable operations department in the future will ultimately provide its service of maintaining buildings and properties while achieving the acha four Sustainability Objectives[35] to:

SO1) …eliminate the contribution of Operations to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of Operations to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of Operations to systematic physical degradation of nature;

SO4) …eliminate the contribution of Operations to the undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of the maintenance and operations in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

[35] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to the sectioned called *The Natural Step Framework*.

1. Operations is a heavy consumer of **energy** through 36 vehicles, numerous buildings, and many pieces of equipment under its responsibility. In one year, Operations spends approximately $1.7 million on electricity[36], and $1 million on furnace oils.

    - The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects.

    - The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

    - The *transportation of products* upon which Operations relies also contributes to systematic increases to the impacts associated with fossil fuels, especially if products are transported over large distances from the manufacturer to HRM, which is the case for some products. In addition, The mode of transportation affects the degree of these impacts. For example, transportation by train is more fuel-efficient than transportation by train, and has few sustainability challenges associated with fossil fuels.

2. Operations is also responsible for **lighting** in buildings and in outdoor facilities such as stadiums. Bulbs consume electricity to provide light, therefore improved efficiency of light bulbs should lead to a decrease in energy consumption and its related sustainability impacts. However, an additional sustainability challenge related to light bulbs is the potential introduction of larger amounts of mercury (SO1), a trace metal, into the waste stream and ultimately into nature. Many energy efficient light bulbs contain larger amounts of mercury. If these light bulbs are disposed of in landfill or through incineration, it may lead to a rise in the concentration of mercury.

3. The use of **chemical compounds** may result in the systematic accumulation of these substances in nature leading to unforeseen negative effects, especially if these chemicals are persistent compounds (those that do not breakdown easily). For example, the widespread use of DDT as a pesticide leads to human health problems in humans and the use of CFCs ("Freons") as coolants leads to deterioration of the ozone layer. Operations use a number of chemical compounds to provide its services to other HRM departments, which result in a number of sustainability challenges. These are described below.

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[36] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

- *Cleaners* may contain a number of chemical compounds that are persistent. For example, many cleaners contain volatile organic compounds from petrochemical-based solvents that may be persistent (SO2). In an indoor setting, this is of particular concern because concentrations of VOCs may reach levels high enough to cause negative impacts to human health (SO4). HRM spends $75,000 per year on cleaners and chemicals for pools (mentioned below).

- *Chlorinated oxidizing agents* in pools can also lead to the development of persistent organic compounds, when chlorine combines with organic materials in sewer systems to form chlorinated organic compounds (SO2). These compounds are persistent, and some are suspected of being carcinogenic.

- *Paints* contain volatile organic compounds from petrochemical-based solvents (SO2). HRM spends approximately $100,000 per year on paints. VOCs have been linked the formation of smog, contributing to poorer outdoor air quality. In an indoor setting, they are of particular concern because concentrations of VOCs may reach levels high enough to cause negative impacts to human health (SO4). In addition, some paints contain trace metals, such as cadmium (SO1), for pigments. Paints are of concern because they are used in a dissipative manner (i.e. spread over surfaces) and are difficult to recover afterwards. Operations spends $6,000 per year to dispose of paint cans because of the sustainability challenges associated with paints.

- *Freon* is a CFC, and is persistent in nature (SO2) and its systematic accumulation has resulted in the depletion of the ozone layer. Freon is used in aerosol cans within the Operations department.

- *Deicers* contain phosphates (SO2) to mitigate its corrosive effect. An overabundance of phosphates in water systems (e.g. lakes) can cause the growth of large amounts of algae that deplete oxygen levels, resulting in the death of aquatic wildlife. The use of large amounts of deicers may contribute to this result.

- For materials associated with *vehicle maintenance* (coolants, oils and lubricants, tires, batteries), please see appendix on Fleet Management.

4. One of the primary roles of Operations is the maintenance of buildings, which involves the use of a wide range of **building materials**. For more information on building materials, please refer to the section on *Facilities – Capital*. Some of these materials of particular interest to Operations are elaborated below with their sustainability challenges.

    - The sustainability concerns associated with *wood products* primarily concern the management of resources. For example, the use of wood, a renewable resource, may contribute to the systematic physical encroachment into nature in the form of deforestation (SO3) or promotion of less resilient monocultures (SO3) if wood is harvested from sources where sustainable forest management practices are not practiced. In addition, some forestry companies may add synthetic herbicides and pesticides (SO2).

- In addition, *wood products* may contain trace metals (SO1). For example, to produce pressure-treated wood, wood is first bathed in preservative pressed into the wood using high pressure. A common preservative is CCA (chromated copper arsenate). Over time small amount so chromium, copper and arsenic (SO1) leak out into the ground and ground water, or are released when the wood is burned. These metals are found in low concentrations in nature and therefore a small input can increase in concentration relatively quickly.

- Operations spend 20% of its budget to hire contractors to replace *asphalt shingles* on the roofs of its buildings. Although, old asphalt roofing tiles are chipped up and used as siding for roads, the use of asphalt roofing also leads to the "urban heat island" effect, where dark roofs in buildings lead to higher temperatures, and heavier energy demands on cooling (SO1).

Transition Guidelines

Making this shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from Operations are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that systematic steps are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From Operations that…	To Operations that…
1	**Uses non-renewable energy sources (such as gasoline for engines or propane for space heating)**	**Uses renewable energy sources, such as solar, geothermal, wind or bio-fuels.**
A Step in the Transition: Solar Panels at Swimming Pools Solar panels are installed at one HRM swimming pool to use energy from the sun for heating. By using renewable energy, HRM is eliminating the contribution of fossil fuel-related sustainability challenges. A next step can be to ensure that the materials used to construct the solar panels are managed in a sustainable manner (e.g. reused or recycled). A Step in the Transition: Natural Gas Furnaces 50% of HRM buildings have furnaces that can use natural gas as well as heating oil. Currently natural gas is not widely available in Halifax. The use of natural gas can be seen as a step in the transition to a sustainable society, as it reduces the sustainability challenges of using fossil fuels for space heating, e.g. lowering the rate at which carbon is increasing in concentration in the atmosphere.		
1	**Uses low efficiency buildings and vehicles.**	**Uses high efficiency buildings and vehicles.**

A Step in the Transition: Energy efficient equipment

Although, there is no program to purchase energy efficient equipment, there are some examples where energy efficient equipment offers advantages over less efficient equipment. Energy efficient equipment has the advantage of both reducing carbon emissions and reducing energy costs. An example is the *Emerga Dehumidification System*. It is a system from Sweden installed at a HRM pool that uses only 7% of the energy of other similar systems. Staff from HRM comment that the system is 10 years old but it is still considered state of the art. The use of energy efficient equipment is an example of a *dematerialization*, i.e. using less. This can be contrasted to the solar panel example, which is a case of *substitution*, i.e. replacing one source (fossil fuel) with another (solar). Both these types of actions can help to systematically move HRM towards achieving the ultimate Sustainability Objectives.

A Step in the Transition: Preventative Maintenance Program

The Preventative Maintenance Program at HRM is one of the best in the country. Preventative maintenance can improve the energy efficiency of buildings by ensuring that equipment is operating at optimum levels. For example, the program requires that staff check that furnace burners are burning properly, which improves their efficiency from 60% to 80%.

1	**Use non-renewable materials (such as petroleum products – e.g. nylon, polyester, etc.)**	**Use renewable materials**
1 and 2	**Use scarce metals and synthetic materials as product ingredients (e.g. cadmium, mercury, lead)**	**Uses renewable, sustainably harvested materials, and plentiful metals.**

A Step in the Transition: Criteria for Products and Contracts

There are some instances where criteria for environmental performance were included in products procured (e.g. freon-free aerosol cans) and service contracts (e.g. requirements that contractors use citrus-based cleaners instead of petrochemical based cleaners). Although there are cases of this type of approach, it is only done currently in an ad-hoc manner, and there are no policies or systems in place to support it.

3	**Uses large amounts of natural materials that contribute to physical degradation of natural areas.**	**Uses natural materials efficiently from sustainable harvested sources.**
3	**Relies on intensive use of water.**	**Conserves water.**
4	**Uses products produced with low efficiency product development processes from remote locations.**	**Uses products produced with high efficiency product development processes primarily from regional and local locations.**
4	**Gives no consideration to labour standards or human rights where the products were manufactured.**	**Considers people's basic needs elsewhere by including labour standards and human rights in the places where the products were manufactured (e.g. "fair trade" coffee).**
4	**Discharges building materials and products as solid waste after use.**	**Keeps materials and products "in the loop" by re-use, recycling or**

products as solid waste after use.	manufacturer's extended responsibility.
A Step in the Transition: Recycling of Building Materials 60% of building materials are required by a municipal bylaw to be recycled. The Operations group supports this by ensuring that materials are recycled where possible. Ideally in a sustainable society, materials can be used indefinitely for the same purpose (e.g. wood from buildings re-used in new construction projects) rather than re-used in lower quality purposes (e.g. wood from buildings made into wood chips).	

Appendix IX: Parks and Open Spaces[37]

Overview

Real Property and Asset Management (RPAM) is responsible for the maintenance of and capital improvements to HRM's parks, playing fields, playgrounds, and greenbelts. This includes such functions as litter pickup, maintaining flowerbeds and trees[38], aerating, fertilizing, and mowing grass in parks, municipal cemeteries, and green belt connectors. It also includes maintaining and upgrading recreation facilities such as walking trails, beach areas, boat launch areas, and playing fields, including lining sports fields. RPAM also operates its own greenhouses, where it grows the 250,000 bedding plants used throughout the park system each year.

Overall, RPAM is responsible for over 1700 sites, including approximately 825 park properties, almost 400 playgrounds, 7 cemeteries, and 400 playing fields that host 30,000 organized outdoor sport participants annually. Approximately 120 new parks are added on an annual basis, with the largest park being 4200 acres and the smallest being 2800 sq. ft. About 70 trucks are used to maintain the parks and open spaces, in addition to numerous pieces of motorized equipment, such as wood chippers, lawnmowers, utility tractors.

RPAM's budget for parks and open spaces is approximately $10 million, and it employs 140 full-time employees and 20 seasonal workers for parks and open spaces. It contracts out most grass mowing services and some other services such as custodial services, fencing, and spring and fall clean-up.

Sustainability Objectives

In a sustainable future, parks and natural areas must be maintained while achieving the acha four Sustainability Objectives[39], which are to:

SO1) …eliminate the contribution of parks and open spaces to systematic increases in concentrations of substances from the earth's crust;

SO2) …eliminate the contribution of parks and open spaces to systematic increases in concentrations of substances produced by society;

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[37] Includes sports fields and greenspaces

[38] There are over 25,000 street trees in urban areas of the HRM, and many hundreds of thousands more in parks and green areas. Up to a million trees were lost in the HRM during Hurricane Juan in September 2004. Parks has been responsible for the post-hurricane clean-up of the downed trees, e.g. removing fire hazards, etc. This has generates more than 60,000 cubic metres of woodchips, which will likely go to compost.

[39] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to the sectioned called *The Natural Step Framework*.

SO3) …eliminate the contribution of parks and open spaces to systematic physical degradation of nature;

SO4) …eliminate the contribution of parks and open spaces to the undermining of people's ability to meet their needs.

Current Reality

Parks and open spaces are a major contributor to quality of life (SO4) and the protection of natural areas (SO3) in an urban setting. In this sense, their existence in the HRM is important from a sustainability perspective. How the parks and open spaces are managed also affects the impact of the HRM on sustainability. A number of sustainability challenges exist and are identified below:

1. The maintenance of parks and open spaces consumes considerable **energy** through HRM's associated facilities, vehicles, and equipment and those of its contractors. Energy is primarily consumed in the form of fossil fuels, either through oils for space heating, coal for electricity[40], or gasoline and diesel for mobility and equipment. In one year, RPAM spends approximately $1.1 million on electricity, and $1.1 million on furnace oils for parks and open spaces, and $1 million on grass mowing services. This does not include an additional $1.5 million that is spent on energy requirements for some recreational facilities that are managed by third parties for the HRM (e.g. Halifax Metro Centre).

   - The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity) and *gasoline and diesel* (mobility, mowing, and other equipment) results in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects (SO4).

   - The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

   - The *transportation of products* supplied to RPAM for the maintenance of parks and open spaces also contributes to systematic increases to the impacts associated with fossil fuels, especially if products are transported over large distances, such as fertilizers, field paints and equipment. The mode of transportation also affects the degree of these impacts. For example, transportation by train is more fuel-

[40] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

efficient than transportation by truck, resulting in fewer sustainability challenges associated with fossil fuels.

- The maintenance of parks and open spaces generates a considerable amount of **solid and organic waste.** Solid waste collected in parks is not separated at source, however organics and recyclables are separated at a waste management facility. Organic waste is generated from mowing, clippings, tree-trimming, and flowerbeds. If organic waste is not composted and is instead sent to landfills (SO3), it releases methane (SO2), a major greenhouse gas, when it breaks down. Each year, more than 6000 metric tones of yard waste and 1500 metric tonnes of wood chips are generated by the HRM through the maintenance of its parks. Most of this is processed in-house and used by the HRM as compost or for trails.

2. Although parks and other natural areas are desirable from both a quality of life perspective and an environmental perspective, facilities such as playing fields involve some **encroachment into natural areas**. RPAM assesses more than 220 new subdivision applications for public parkland and open space annually. A continuous expansion of the related developments represents a sustainability challenge, as it results in a systematic encroachment into natural areas (SO3). In general, however, this challenge is more associated with Regional Planning than with the maintenance of parks. Such land use issues are discussed in more detail in the section of this report on *Land Use and Transportation*.

3. The maintenance of parks and open spaces depends on a variety of **materials**. The way that materials are managed affects the degree to which they contribute to sustainability challenges. While some of the materials used to manage parks and open spaces are of relatively minor importance in terms of their sustainability impacts, a few select materials and their sustainability challenges are elaborated upon below.

    - The maintenance of bent-grass lawns in parks, playing fields, bowling greens and cemeteries requires ***fertilizers***. A number of sustainability challenges are associated with industrial fertilizers, including the potential for phosphate run-off into waterways (SO1), as well as the energy (mostly SO1), emissions (SO2), physical degradation of nature (SO3) and release of scarce metals and sulfur compounds (SO1) often associated with the mining of phosphorous and production of the fertilizers. HRM does not depend entirely on industrial fertilizers, however, as it uses a mixture of topsoil and compost generated from its in-house composting facility as a natural fertilizer.

    - Playground facilities and equipment may introduce some sustainability challenges, depending on the materials used and the way that they are managed. For example, some playgrounds have used ***wood*** for equipment and/or for fencing. Sustainability challenges associated with wood could include wood harvested from unsustainable forestry practices (SO3) or treated with chemicals to prolong their life (SO2). These are explored in more detail in the section of this report on building materials (see below).

- RPAM uses ***paint*** to line playing fields. Some paints contain volatile organic compounds from petrochemical-based solvents (SO2). The sustainability challenges associated with paints are outlined in more detail in the section on Facilities – Operations.

- The facilities in the parks and the buildings that RPAM relies upon to maintain the parks consist of a variety of ***building materials*** that have varying sustainability impacts. For an analysis of the sustainability challenges associated with building materials, please see the sections of this report on Capital Projects and Facilities – Operations.

- For materials associated with ***vehicle maintenance*** (coolants, oils and lubricants, tires, batteries), please see appendix on Fleet Management.

- The maintenance of parks and playing fields also depends on a variety of materials such as nets and basketball standards. These are considered immaterial for the purposes of this analysis.

4. RPAM spends approximately $200,000 per year on **water** for the maintenance of parks, cemeteries and playing fields. Although Halifax draws its water primarily from two nearby lakes for which replenishing the water supply (SO3) is not a major concern, any inefficient use of water is a sustainability challenge in that it wastes resources (SO4) and increases the demands on water management infrastructure, such as pumping and waste-water treatment facilities (SO1 and others). The issues associated with water are explored in greater detail in the sections of this report dealing with *Water Supply* and *Waste Water*.

Transition Guidelines

Making a shift from the current reality to the sustainable future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from Parks are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From parks and open spaces that…	To parks and open spaces that…
1	**Are maintained using non-renewable energy sources (such as gasoline for engines or propane for space heating)**	**Are maintained using renewable energy sources, such as solar, geothermal, wind or bio-fuels.**
1, 2, 3, 4	**Are maintained using low efficiency buildings, vehicles, and practices.**	**Are maintained using high efficiency buildings, vehicles, and practices.**

A Step in the Transition: Field Turf

HRM has introduced a product called Field Turf as a substitute for grass on three of its playing fields. Field Turf is an artificial surface, made from plastic, with Nike Grind (ground up shoes, tires, etc) underneath. There are many efficiencies associated with Field Turf fields. First, a Field Turf field requires almost zero maintenance, as compared to a regular grass field, which requires approximately $15,000-$20,000 in maintenance per year (including mowing, topsoiling, fertilizing, etc). In addition to saving money, this lessens the HRM's contribution to the sustainability impacts associated with these maintenance activities, such as greenhouse gases from fuel combustion (SO1), the impacts of industrial fertilizers (SO1,2,3), and water use (SO3). In addition, Field Turf fields will last about 15 years, compared to five years for regular fields; they can be used for 60 hours per week, as compared to 20 hours per week for regular fields; and they last much longer into the season. This means that the fields are used considerably more for recreational activities (SO4). Finally, users prefer the Field Turf fields, so much so that they are willing to pay to use them. There are therefore both additional revenues and major cost savings in the long-run for HRM with Field Turf fields.

Despite the many efficiency gains associated with its use, Field Turf could introduce some new sustainability challenges for HRM, depending on how it is managed at the end of life. If the Field Turf is sent to landfill, it contributes to the challenges associated with that method of waste disposal. It would seem that this challenge could be overcome, however, as Field Turf could conceivably be re-used or recycled at the end of its life.

1	**Are maintained using scarce metals, non-renewable and synthetic materials**	**Are maintained using sustainably harvested renewable materials, biodegradable materials, and abundant metals.**

A Step in the Transition: Non-treated lumber

HRM uses only non-treated lumber for new playground facilities. Wood is a natural, renewable material that can be harvested sustainably (SO3). Non-treated lumber contains none of the scarce metals (SO1) and synthetic compounds (SO2) present in treated lumber, and lessens the potential for negative human health impacts (SO4).

1,2,3	**Rely on unnatural and excessive fertilizer, herbicides and pesticides and exotic plant species**	**Are maintained using biological pest control, natural fertilizer, native plants and other naturescaping[41] techniques**

[41] Naturescaping is landscaping that is designed to have a minimal impact on the environment. It features native plants, nature-like settings, minimal use of chemicals and low water-use gardening techniques.

A Step in the Transition: No chemical pesticides

The HRM was the first major city in Canada to pass a bylaw restricting the use of chemical pesticides. The Pesticide By-law (p-800) is a municipal by-law that regulates the use of pesticides on residential and municipal properties in HRM. It was passed by HRM Council in August 2000 and came fully into effect on April 1, 2003. Parks have therefore used no chemical pesticides (SO2) in the maintenance of HRM's parks and greenhouses since August 2000.

A Step in the Transition: Compost for fertiziler

Parks has an internal composting facility where it composts clippings and other organic waste produced through its operations. This facility produces more than 8,000 tonnes of compost per year, which is used primarily as mulch for trails, school gardens, etc. This substantially reduces the HRM's potential contribution to greenhouse gas emissions that would result from the release of methane (SO2) if the organic waste were sent to landfill. Compost is also mixed with topsoil and used as a fertilizer on HRM's playing fields, thereby reducing the amount of industrial fertilizers required and the associated sustainability challenges (SO1,2,3).

A Step in the Transition: Sustainable Landscaping

HRM's Parks and Open Spaces department is a member of Landscape Nova Scotia, whose mandate is to promote the creation of safe and sustainable greenspace, using environmentally sensitive construction and horticultural practices. It is also a signatory to Landscape Nova Scotia's "Sustainable Landscape" Guidelines, which provide guidance on biological vs. chemical controls, proper soil management, landscaping using native species, etc. (SO2, 3).

3	**Physically degrade natural areas in a systematic manner (e.g. by causing an accumulating degradation of local habitat)**	**Cause no net degradation of natural systems**
3	**Use large amounts of natural materials that contribute to physical degradation of natural areas.**	**Use natural materials efficiently from sustainable harvested sources.**
3	**Are maintained using techniques that require an intensive use of water.**	**Are maintained using techniques that conserve water.**

A Step in the Transition: Switch from water to glycol for cooling iceplant compressor

In 2001, a new technique was introduced for cooling a compressor used in an HRM arena's iceplant. The new technique uses glycol rather than water, resulting in a large dollar savings in water costs with a 2-3 year financial payback. The new technique also extends the lifespan of the compressor by 5-10 years by avoiding the corrosives in water. The glycol can be cleaned and recycled.

4	**Use equipment produced with low efficiency product development processes from remote locations.**	**Use equipment produced with high efficiency product development processes primarily from regional and local locations.**
4	**Use equipment and products where no consideration has been given to labour standards or human rights where it is manufactured.**	**Use equipment and products where people's basic needs elsewhere have been considered by including labour standards and human rights**

	where it is manufactured.	**in manufacturing (e.g. "fair trade" coffee).**
1,2,3,4	**Concentrate recreation in areas removed from residents' homes and place of work, and visitor accommodations.**	**Offers diverse recreation options that are easily accessible throughout the community and accessible with transit.**
A Step in the Transition: Allocation of land for park space in new developments Developers in the HRM are required by by-law to give 5% of the land of new developments (or the equivalent financial payment) to the municipality to be used for park space. This ensures that the quality of life benefits of parks and open spaces (SO4) and some green space (SO3) are accessible throughout the community.		

Appendix X: Fleet Services

Overview

Fleet Services is a part of Real Properties and Asset Management (RPAM) and is responsible for the maintenance, repair, and replacement of Halifax Regional Municipality's (HRM) stock of vehicles. This stock of vehicles includes:

- A General Fleet of over 600 vehicles including cars, trucks, and snowplows.
- A Transit Fleet of over 200 buses, and 6 ferries.
- An Emergency Fleet of 270 vehicles (e.g. fire trucks and ambulances) and 200 police cruisers.
- Small equipment with motors, such as lawn mowers.

Fleet services manages a number of facilities such as the police garage, a 200,000 square foot garage and a 50,000 square foot garage. One more garage is under consideration to improve services for the emergency services fleet.

Sustainability Objectives

Sustainable fleet services in the future will ultimately provide its service of operating and maintaining vehicles while achieving the acha four Sustainability Objectives[42] to:

SO1) …eliminate the contribution of Fleet services to systematic increases in concentrations of substances from the Earth's crust;

SO2) …eliminate the contribution of Fleet services to systematic increases in concentrations of substances produced by society;

SO3) …eliminate the contribution of Fleet services to systematic physical degradation of nature;

SO4) …eliminate the contribution of Fleet services to the undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of fleet services in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

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[42] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to Section X "Introduction to the Natural Step Framework for Sustainability".

1. Fleet Services is a heavy consumer of **energy**, through its fleet of vehicles and facilities. Energy is primarily consumed in the form of fossil fuels, either through oils for space heating, coal for electricity[43], or gasoline and diesel for mobility.

- The combustion of *fossil fuels* such as *furnace oils* (heating), *coal* (electricity) and *gasoline* (mobility) result in the systematic accumulation of substances such as carbon dioxide (SO1), sulfur oxides (SO1), heavy metals (e.g. mercury) (SO1), volatile organic compounds (SO2), and nitrous oxides (SO2) in the atmosphere. The systematic accumulation of these substances results in downstream effects such as climate change, acid rain, smog, and negative human health effects (SO4). Each year, Fleet Services spends $5 million dollars on diesel fuel for its Transit fleet, which is approximately 10 million litres per year. Idling is also a concern for HRM as it is an inefficient use of fuel.

  The garages of Fleet Services are heavy consumers of electricity due to the equipment used to maintain vehicles, such as compressors, hoists, ventilation systems, and pumps. For the garage that services the Transit fleet alone, the electricity bill is $250,000/year.

  Currently there are no guidelines used for the purchase of vehicles based on fuel efficiency. Developing a set of guidelines has been mentioned as an opportunity for improvement by HRM staff.

- The use of fossil fuels also results in a number of indirect impacts generated from the production of fossil fuels. These include physical disruption of land through exploration and extraction (i.e. drilling and mining) (SO3), the release of trace metals through mining (SO1), and the release of persistent chemical compounds when refining fossil fuels (SO2).

  - The *transportation of products* supplied to Fleet Services on also contributes to systematic increases to the impacts associated with fossil fuels, especially if products are transported over large distances from the manufacturer to HRM. In addition, the mode of transportation affects the degree of these impacts. For example, transportation by train is more fuel-efficient than transportation by truck, and has fewer sustainability challenges associated with fossil fuels.

2. Fleet Services also uses a number of **materials** in order to maintain its fleet of vehicles. Currently there are no guidelines used for the purchase of vehicles and other materials that take into account social and environmental performance. Developing a set of guidelines has been mentioned as an opportunity for improvement by HRM staff. Some materials and their sustainability impacts are discussed below.

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[43] Electricity for HRM is provided by Nova Scotia Power Inc. (NSPI), which produces electricity primarily from fossil fuels sources that are carbon intensive. 65.3% of electricity is generated from coal and 24.1% is generated from oil.

- Fleet Services spends $100,000 each year on **lubricant oils** for its vehicles. Lubricants are derived mainly from carbon-intensive fossil fuels and contain chemical additives. When the lubricant is used in vehicles, trace metals from the engine enter into the lubricant. In addition to the sustainability challenges posed by the energy consumed in the production process, lubricants pose a sustainability challenge if carbon-intensive fossil fuels (SO1), additives (SO2) and trace metals (SO1) are allowed to dissipate into nature, for example through leaks onto road ways or if they are disposed of through water systems or on land.

- Fleet Services spend $350,000/year on tires. In the course of their use, **tires** experience abrasion from extensive contact with the road surface. Tire abrasion is composed of rubber, carbon black, and mineral oils, all of which contain substances originally extracted from the earth's crust (SO1), plus the chemical additives (SO2) in the tire. The tire abrasion is first spread temporarily over the road surface and then in the ground to both sides of the road when it is washed off the road by rainwater. While many of the organic components of the tire decompose within approximately two years, traces of many of the inorganic components (e.g. zinc oxide, cadmium oxide, lead oxide) are left behind. Tires also pose a sustainability challenge at the end of their life if they are disposed of in large tire piles. If we are dependent on landfills or tire piles as the ultimate form of tire disposal, then it will result in a systematic physical encroachment of nature (SO3).

- Although **batteries** are not a large part of Fleet Services budget, they contain a significant amount trace metals, such as cadmium, lead, and lithium. Trace metals found in batteries are not abundant in nature, and therefore small flows of these metals can increase its their concentration. High concentrations of trace metals, such as cadmium, have been linked to a number of negative health impacts.

3. In addition to the materials mentioned above, Fleet Services also relies on a number of other materials, although to a lesser extent. These include **antifreezes, cleaning agents,** and **paints**. In general, these products are produced from petrochemicals and contain a number of additives that may be persistent and/or found in low levels in nature. For example, cleaning agents and paints contain petrochemical based solvents, many of which are volatile organic compounds (VOCs) (SO2). VOCs in high concentrations, such as in indoor situation have a negative effect on human health (SO4). Also, their accumulation in nature promotes the formation of smog. In addition, these materials, may also contain trace metals (SO1) such as cadmium as a dye in paints. Since trace metals are not found in high concentrations in nature, a relatively small input can increase their concentration.

4. Capital purchases in the form of **vehicles** account for $20 million/year of the Fleet Services budget. In addition, Fleet Services also spends $5 million/year in **vehicle parts**. In addition to the sustainability challenges associated with energy consumption in vehicles, the management of the materials pose a number of sustainability challenges.

- **Mercury** (SO1) is found in light switches, antilock braking systems and some headlights and is not recovered during the recycling process. Mercury is a trace metal that is bioaccumulative, persistent, and toxic. Since mercury exists in very low concentrations in nature, an increasing concentration threatens the health of humans and wildlife.

- When vehicles reach the end of their life, useful parts and metals are removed, and what remains is shredded and discarded as **automobile shredder residue** (ASR). ASR contains many persistent chemical compounds (SO2) commonly found in the plastics, foam, textiles, glass, and rubber. In 1996, 200,000 tonnes of ASR was disposed of in Canada. As ASR is classified as hazardous material in Quebec and other North American jurisdictions, this suggests it poses a risk to the environment. In addition, some ASR is incinerated to recover the energy content, which is of concern due to dioxins in PVC plastics (SO2) being released into the air. ASR is currently disposed of in landfill in Nova Scotia.

- **Hydrochlorofluorocarbons (HCFCs)** (SO2) have replaced chlorofluorocarbons (CFCs) in air conditioners, but can still deplete the ozone, especially if used in large quantities. HCFC is also a known greenhouse gas.

5. Fleet Services is also a large consumer of **water** though cleaning every bus every night of the year. Specific sustainability challenges leading from the consumption of water are covered in further detail in the section on water.

Transition Guidelines

Making this shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from Fleet Services are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From fleet services that…	To fleet services that…
1	**Uses non-renewable energy sources (such as gasoline or diesel)**	**Uses renewable energy sources, such as biodiesel, electric or hydrogen (from renewable power sources**

A Step in the Transition: Bio-diesel

HRM is replacing traditional diesel fuel with a mixture of traditional diesel and bio-diesel, consisting of 20% fish oil, called "B20". This is expected to result in lower carbon dioxide emissions. This substitution represents a shift form non-renewable to renewable energy sources. Although HRM should be commended for undertaking an initiative that reduces a systematic increase of a substance from the Earth's crust, there are other challenges that need to be addressed.

- The fish oil used in the production of B20 is considered a waste product of another manufacturing process, however one concern raised in the consultations concerns the potential contribution to over-consumption of fish stocks if the bio-diesel were used to meet all transportation needs. If this were the case, then this initiative may inadvertently create a new problem (systematic physical encroachment into nature (SO3)) while reducing the contribution to systematically increasing substances from the Earth's crust in nature (SO1).
- In addition, fish is shipped in over a large distance from Peru to provide the oils. This contributes to sustainability challenges associated with transportation.
- Nitrous oxides (SO2) are still produced from B20. The result of a increase in concentration of nitrous oxides is the formation of smog, leading to poorer urban air quality, and acid rain.

1	**Uses low mileage vehicles and single or low occupancy vehicles**	**High mileage vehicles and multi-passenger vehicles**
1 and 2	**Uses large vehicles manufactured from scarce metals and synthetic materials with no consideration for closing the loop**	**Uses smaller vehicles that use closed-loop approaches to vehicle design, manufacture and reclamation (e.g. extended manufacturer responsibility)**
1 and 2	**Uses materials manufactured from scarce metals and synthetic materials with no consideration for**	**Uses materials that use close loop approaches design, manufacture and reclamation (e.g. extended**

	closing the loop	**manufacturer responsibility)**
A Step in the Transition: Recycling (and Downcycling[44]) of Materials Recycling materials refers to keeping materials in tight technical cycles where 100% of materials are reused at the same level of service indefinitely. For example, where solvents are separated out and reused as solvents over and over again. The importance of keeping materials in tight technical cycles addresses primarily the objectives of eliminating systematically increasing concentrations in nature of 1) substances from the Earth's crust and 2) substances produced by society. If trace metals and/or persistent chemical compounds (e.g. CFCs) are not released into nature then these sustainability objectives are achieved. Recycling materials reduces the sustainability challenges associated with the extraction and processing of virgin materials, and is a positive step in the transition towards a sustainable society. Many of the materials used by Fleet Services are diverted from the landfill and wastewater systems and recycled. These include oils and antifreeze, which are captured and reused in the same application (e.g. reuse antifreeze to make antifreeze indefinitely). Other materials are downcycled and reused for lower quality purposes. These include certain parts of tires, cardboard, wood, steel, and aluminum are separated out and sent to recyclers.		
3	**Uses large amounts of natural materials that contribute to physical degradation of natural areas.**	**Uses natural materials efficiently from sustainably harvested sources.**
3	**Relies on intensive use of water.**	**Conserves water.**
4	**Uses fuel in an inefficient manner (e.g. idling or driving habits that decrease fuel efficiency)**	**Uses fuel in an efficient manner.**
A Step in the Transition: Smart Driver Program HRM has participated in a program to educate transit bus drivers on driving techniques and habits that increase fuel efficiency and reduce stress.		
4	**Uses products produced with low efficiency product development processes from remote locations.**	**Uses products produced with high efficiency product development processes primarily from regional and local locations.**
4	**Gives no consideration to labour standards or human rights where the products were manufactured.**	**Considers people's basic needs elsewhere by including labour standards and human rights in the places where the products were manufactured (e.g. "fair trade" coffee).**

[44] Downcycling refers to the recycling of a waste stream to create a new material that has properties inferior to those of the original virgin materials. For example, when plastic bottles are used to create fleece jackets. Fleece jackets can not be made into pop bottles and therefore, it is only a way station to the ultimate destination of the landfill.

Appendix XI: Recreation, Tourism and Culture

(This appendix was written based on an initial consultation with HRM staff, however due to time constraints relating to scheduling problems, the text has not been formally reviewed by HRM staff, as with the other appendices.)

Overview

The Recreation, Tourism, and Culture performs the following primary functions:

Recreation Programming offers over 5,000 direct programs (fitness, crafts, art, culture, camps, music, dance, drama, etc.) as well as facilitated membership and drop-in services and an Outdoor Recreation and Earth Education section. Programs operate in HRM owned community recreation centres and other rented facilities like schools, church halls, and community halls. In addition, programming operates pools, a summer beach program, swimming lessons, recreational swims, and coordinates arena bookings for four Halifax Regional Municipality owned arenas.

Community Development supports over 180 community groups and not-for-profit agencies annually through assistance with marketing and promotions, financial management, board development, facility management, business and strategic planning, and leadership and volunteer training.

Culture and Heritage staff preserve, present and promote the cultural, historical and natural assets of HRM. Program delivery in this area includes development of cultural policy, increasing public understanding of cultural and heritage assets, developing community partnerships to deliver programs, facilitating cultural and artistic growth, and increasing community capacity through facility management and capital investment in cultural infrastructure.

Visitor Services acts as both host and sales force. As hosts, Visitor Services personnel greet and welcome visitors at eleven seasonal and one year round visitor centre, through a cruise ship greeting program and at conferences. Additionally, staff develop an annual visitor guide, map and brochures for attractions, and maintain a website and events calendar. In its capacity as a sales force, Visitor Services provides information to visitors by responding to off-site requests for information (by fax, phone, mail, email or website request), provides travel ideas for visitors, encourages them to extend their stay, and acts as ambassadors for the community.

Civic Events and Festivals manages special events that are implemented directly by HRM and/or require support from HRM. Civic Events and Festivals manages human and financial risk to the municipality created by special events, and provides consultation and coordination of municipal services and infrastructure to outside festival organizers for events organized and implemented by the private sector.

This section continually seeks alternative funding resources for events through the development of comprehensive sponsorship campaigns and the encouragement of partnerships with other agencies and businesses

Sustainability Objectives

In a sustainable future, the HRM must ultimately provide residents and visitors access to recreation and cultural programs while achieving the acha four Sustainability Objectives[45], which are to:

SO5) …eliminate the contribution of Recreation, Tourism and Culture to systematic increases in concentrations of substances from the Earth's crust;

SO6) …eliminate the contribution of Recreation, Tourism and Culture to systematic increases in concentrations of substances produced by society;

SO7) …eliminate the contribution of Recreation, Tourism and Culture to systematic physical degradation of nature;

SO8) …eliminate the contribution of Recreation, Tourism and Culture to undermining of people's ability to meet their needs.

Current Reality

The following sections discuss the current reality of Recreation, Tourism and Culture in HRM with respect to the four Sustainability Objectives. The *Current Reality* section discusses the challenges of transportation to achieving these objectives. The *Transition Guidelines* section discusses current initiatives to overcome these sustainability challenges and places them within broad guidelines for a transition to a sustainable future.

1. Recreation, Tourism and Culture (RTC) is a positive contributor to Sustainability Objective #4 for HRM, i.e. to eliminate conditions that systematically undermine people's ability to meet their needs[46]. There are two parts to this statement that are relevant to our discussion about RTC and sustainability. The first is that RTC

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[45] The 4 Sustainability Objectives are derived from The Natural Step's Four System Conditions for a Sustainable Society. For an elaboration of the System Conditions, please refer to Section X "Introduction to the Natural Step Framework for Sustainability".

[46] By human *needs* we mean in-born requirements that need to be satisfied in order for people to remain *healthy* – physically, mentally and socially. Needs are not synonymous either with our *wishes* (although at times these may be expressions of our needs) or the *ways* in which we seek to satisfy our wishes and needs.

There have been many excellent attempts made at understanding human needs, from the most basic to the more complex and advanced, and these usually have a great deal in common. One of the most well known examples is the definition of nine distinct human needs by the Chilean economist Manfred Max-Neef: subsistence, protection, participation, idleness, creation, affection, understanding, identity, and freedom.

There are other models of human needs and various frameworks for their academic study. TNS has chosen to use the Max-Neef analysis for the purposes of this discussion for two reasons. Firstly they encompass the most basic of needs, still a priority in too many parts of the world, as well as human needs beyond the basics of physical survival which are pertinent to us all. Secondly they give a deeper foundation, and set the context for, other descriptions such as the Universal Declaration of Human Rights.

provides programs and initiatives that act as *satisfiers* for needs, i.e. the *means* to meet needs. This is to say that its mandate is to ensure that its activities act as satisfiers for needs. The second is that it removes barriers or conditions that prevent citizens of HRM from accessing these programs and initiatives. For example, programs that are expensive constitute an economic barrier to people's ability to meet their basic human needs. Therefore, by ensuring that programs are affordable and accessible by all, RTC is eliminating a condition that systematically undermines a person's ability to meet their basic human need. A further discussion of the needs that RTC provides satisfiers for are mentioned below.

- Through volunteer opportunities and recreational programs RTC provides an opportunity for people to satisfy their need for *participation* (SO4), the desire and ability of people to be involved in life (e.g. through choosing, implementing, playing, etc.). One of the strategic outcomes outlined in the RTC business plan for 2004/2005 is to support citizen involvement by creating volunteer opportunities and assisting volunteer groups, which is the measured through number of citizens volunteering.

- Through opportunities for people to exercise and be active RTC provides an opportunity for people to satisfy their need for *subsistence* (SO4). Subsistence is generally associated with its main satisfiers, such as food and water, however, a means to develop a physically healthy body is also important. In the RTC business plan, one of the strategic outcomes is "Healthy Citizens", which is measured by number of clients in the RTC database, program participation hours amongst others.

- Through its programs and cultural activities RTC also provides opportunities for people to satisfy their need for *idleness* (SO4) or the time and space to relax and reflect. One benefit to clients that RTC strives for in the design of its activities is the opportunity for enjoyment, *relaxation*, social interaction and *stress reduction*.

- Through its arts and crafts programs and volunteer opportunities RTC provides opportunities for people to satisfy their need for *creation* (SO4), or the need to innovate and explore unlimited human potential.

- Through its educational programs RTC provides opportunities for people to satisfy their need for *understanding* (SO4). Understanding is more than knowledge, and includes a deeper sense of insight and enlightenment that comes through awareness, acceptance and interconnectedness of self with others. Opportunities to engage in life long learning and skills development is a key benefit described by RTC to clients.

It is important to note that the programs and activities of RTC should not be seen a panacea for the sustainability of social systems in HRM, but one way to provide satisfiers for needs. HRM may well be putting up barriers to people meeting their basic human needs in other areas. For example, urban design that prevents social interaction by promoting a long time spent in commuting, can act as a barrier to people meeting their

basic needs for participation, understanding, and idleness. This is discussed more in the section on *Land Use and Planning*.

2. Whereas, Sustainability Objective #4 speaks to conditions that undermine social systems, the other three sustainability objectives speak to how natural system are undermined. In a sustainability society all four sustainability objectives must be met since it is ultimately not sustainable to meet human needs in a way that systematically destroys the ability of nature to provide ecosystem services (e.g. raw materials, cleaning air and water, aesthetics, etc). Therefore RTC must provide satisfiers of human needs in a way that is also ecologically sustainable. RTC operates 25 facilities in HRM in order to provide its services to the community. As a result of using these facilities, RTC may systematically undermine nature's ability to provide ecosystem services through use of energy, products, water and the generation of waste and wastewater.

    - These facilities are large consumers of energy in the form of electricity for lighting or oil for space heating. These facilities also require products for maintenance and operations, such as cleaners, light bulbs, chlorinated chemicals for pools, and many others. A more detailed discussion of the sustainability challenges associated with the energy and materials used in facilities can be found in the sections on *Capital Projects, Maintenance and Operations,* and *Procurement*.

    - Operating these facilities also generates an output of materials in the form of organics, recyclable materials, or solid waste. A more detailed discussion of the sustainability challenges associated with the management of materials can be found in the section on *Solid Waste*. Outside of their facilities, HRM also generates waste through special events. It has been noted in consultations with HRM staff that there is no recycling of materials at major events.

    - These facilities also consume a substantial amount of water and generate a substantial amount of wastewater. A more detailed discussion of the sustainability challenges associated with the use of water can be found in the sections on *Water Supply* and *Wastewater*.

    - These facilities also use a substantial amount of land. There are two groups of sustainability challenges associated with land. One concerns how the land is managed, for example, if fertilizers are used or how the lawns are mowed. The sustainability challenges associated with land management are discussed in further detail in the section on *Parks and Open Spaces*. The second group of sustainability challenges deals with the amount of physical land used. If a systematically increasing amount of land is used (e.g. ever-expanding cities, ever-expanding landfills) , then this is not sustainable in the long-term. The sustainability challenges associated with land use are discussed in the section called *Land Use and Transportation*.

Transition Guidelines

Making a shift from the current reality to the desired future will mean systemic changes. Some of these fundamental changes are listed in the table below as guidelines. In addition, some current initiatives from RTC are described under the relevant guidelines to highlight how they support the transition to sustainability.

Please note that these are general guidelines and the approach of actual projects and policies can and will vary. Management decision may emphasize some guidelines over others. The most important consideration is that *systematic steps* are taken towards meeting the four ultimate Sustainability Objectives.

Sustainability Objective	From Recreation, Tourism and Culture services that…	To Recreation, Tourism and Culture services that…
1	**Use non-renewable energy sources (such as gasoline or diesel)**	**Use renewable energy sources, such as biodiesel, electric or hydrogen (from renewable power sources**
1	**Incorporate wasteful and low efficiency energy uses during facilities construction and operations**	**Incorporate energy conservation and efficiency into facilities design, construction and operations**
A Step in the Transition: New Centre for Sustainability Currently in the planning stage is a proposed $3 million Centre for Youth Leadership and Sustainability that would incorporate building innovations that promote the efficient use of resources, use renewable and sustainability harvested building materials, and act as a place for people to learn more about sustainability.		
1 and 2	**Use scarce metals and synthetic materials during construction and maintenance (e.g. VOC's in carpets, etc.)**	**Use recycled materials, sustainably harvested renewable materials, and/or abundant metals (e.g. iron, aluminum, silica)**
1, 2, 3, and 4	**Are physically located in areas that are difficult to access with public transportation**	**Are located in areas that are easily accessible with transit**
4	**Has facility design and operational practices that are wasteful in their use of materials and energy**	**Has designs and operational practices that use energy and materials efficiently**
4	**Focus on identifying problems and solving these with externally imposed solutions**	**Identifying existing capacities and build on these by empowering individuals to meet their own needs**
4	**Are exclusively form and prescriptive in program delivery**	**Offer and facilitate a wide range of formal and informal, participant-led programs and organizations that either provide needs or facilitate situations for people to meet their own needs.**

4	**Meet single specific needs only**	**Meet multiple needs (e.g. neighbourhood groups that watch each others' children and also meet needs for participation, identify, safety and affection)**
4	**Become systematically more expensive and unaffordable**	**Are accessible and affordable to residents as well as visitors**
4	**Promotes exclusively popular culture**	**Fosters creativity and originality, allowing self-organizing and a diverse cultural scene to flourish**
4	**Disregards the history and heritage of HRM and surrounding region**	**Explores and celebrates HRM history and heritage**
<u>A Step in the Transition: Protection and Promotion of Heritage Sites</u> The protection and enjoyment of heritages sites, and cultural diversity is a key strategic outcome of RTC. It success is measured in the number of people attending heritage sites, money spend to protect heritage assets, its investment in community events, and the number of cultural recreation programs it offers.		
4	**Is not readily accessible by all (e.g. affordability, physical access, language)**	**Embraces multiculturalism and is provided in an accessible manner**
4	**Compromises integrity and value for the sake of commercialization**	**Exists for the sake of cultural development with commercial benefit when appropriate and authenticity is ensured**
4	**Focuses on exhibition**	**Provides exhibitions, but also offers opportunities for participation and learning**
4	**Creates economic and political barriers to freedom of expression through cultural, artistic and spiritual pursuits**	**Actively works to dismantle barriers and facilitate freedom of expression**
4	**Segregates different groups of learners**	**Fosters collaborative learning among diverse groups**
4	**Focuses on one-way theoretical learning, lacking interaction with people and nature**	**Encourages experiential as well as theoretical learning, linking learners with nature and the community**

HRM Sustainability Planning Tool

Project Title: _____

Project Department Lead: _____

Briefly describe the project/decision:

In the table below, please make comments regarding the extent which this initiative moves HRM closer to or farther away from its strategic priority of sustainability. Please use specific examples or metrics where appropriate.

Sustainability Goals and Metrics To encourage HRM to:		Not Applicable	Positive, moves HRM toward sustainability goals	Negative, moves HRM away from sustainability goals
General	**Smart use of alternative fossil fuels and metals.**			
specific	…reducing use of fossil fuels			
specific	…encouraging use of alternative fuels and energy sources			
specific	…reducing use of scarce metals			
specific	…encouraging use of recycled, recyclable, reused, and reusable components and materials			
General	**Smart use of synthetic chemicals and substances.**			
specific	…reducing product/chemical toxicity			
specific	…reducing negative impact on human health			
specific	…encouraging use of products made with natural components			
specific	…encouraging use of recycled, recyclable, reused, and reusable components and materials			
specific	…product/chemical is eco-label certified			

Sustainability Goals and Metrics		Not Applicable	Positive, moves HRM toward sustainability goals	Negative, moves HRM away from sustainability goals
To encourage HRM to:				
General	**Smart land and eco-system management.**			
specific	…protection of natural habitat			
specific	…protection and enhancement of green-space			
specific	…improvement of land quality			
specific	…materials taken from well managed eco-systems			
specific	…encouraging use of recycled, recyclable, reused, and reusable components and materials			
specific	…wood taken from FSC certified forest			
General	**Enhance the ability of people to meet their human needs.**			
specific	…creating a safe work environment			
specific	…enhancing inclusive and transparent decision-making			
specific	…improving human health			
specific	…activities encourage community engagement			
specific	…activities support diversity			
specific	…activities that enhance accessibility			
specific	…activities that contribute to the local economy			
specific	…activities that contribute to and/or preserve local culture			

Strategic Questions:	
Adaptability: To what extent and in what way does this decision limit or enhance our ability to take advantage of new technologies, investments, or opportunities that relate to this issue in the foreseeable future?	
Life-cycle Analysis: Does your analysis take into account the full life-cycle of the product/project? Please briefly describe.	
Costs: What are the anticipated costs associated with this decision/investment?	
Return on Investment: In what way will this decision provide a return to the department and/or HRM (financial, environmental, political, social, cultural)?	
Fit with Strategic Priorities: To what extent and in what way does this decision fit with the EMT strategic priorities of HRM? 1. Implementation of Strategic Initiatives 2. Practising Fiscal Responsibility 3. Making HRM an Employer of Choice 4. Providing Excellence in Service Delivery	1. Strategic Initiatives 2. Fiscal Responsibility 3. Employer of Choice 4. Excellence in Service
Fit with other decisions/investments: To what extent is this decision consistent with, complement, or balance with other policies and initiatives?	
Other stakeholders: Have you considered impacts on and influence of other stakeholders (e.g. community, businesses, other HRM departments, etc.)? If so, who and how?	

Overall Sustainability Assessment: Please score each sustainability principle (SP) as to the extent to which this decision/investment/initiative moves HRM toward or away from sustainability. Highest possible score 8, Lowest possible score -8

Strong contribution toward sustainability	**2**	**SP1**	
Weak contribution toward sustainability	**1**	**SP2**	
Neurtal contribution toward sustainability	**0**	**SP3**	
Weak negative impact (against sustainability)	**-1**	**SP4**	
Strong negative impact (against sustainability)	**-2**	**Average Score**	

Other Opportunities: If in the above question "negative impact" for any of the sustainability principles was selected, are there any possible opportunities (even beyond the bounds of this project) to avoid or minimize this?	