City of Sault Ste Marie

Solid Waste Management Plan Environmental Assessment
Alternatives to the Undertaking

June, 2010

EXECUTIVE SUMMARY

The City of Sault Ste. Marie is developing a Solid Waste Management Plan to determine the preferred way to address the waste management needs within the existing service area comprising of the City of Sault Ste. Marie, Prince Township and Batchewana First Nation's Rankin Reserve over the next 20 to 40 years. The Solid Waste Management Plan will include opportunities for both waste diversion and waste disposal.

The City continues to investigate various ways to divert waste from disposal by promoting and developing programs that support the 3R's hierarchy: reduce, reuse and then recycle.

The other component of solid waste management planning, waste disposal, requires the completion of an Environmental Assessment (EA) under the *Environmental Assessment Act*. The City's EA Terms of Reference (ToR), prepared to guide the EA planning process for future waste management, was approved by the Ministry of the Environment (MOE) in September, 2005.

Since that time the City has inventoried the environment within the study area, prepared population projections, analysed historical waste quantities, developed solid waste quantity projections, and identified and evaluated "alternatives to" or functionally different ways of managing residual waste.

In June 2007, the "Waste Quantity Projections and Existing Environment Profile" Working Paper and the "Alternatives to the Undertaking" Working Paper were released. The latter report describes the "alternatives to" being considered and the criteria used to evaluate the alternatives. Public input sessions were held at that time.

This document is a follow-up to the June 2007 "Alternatives to the Undertaking" Working Paper and includes information on the "alternatives to" considered, the results of the comparative evaluation of "alternatives to" and the public and stakeholder input received to date.

The City considered the following "alternatives to":

- Increased waste diversion (ie. developing and promoting programs that support waste reduction, reuse and recycling);
- Incineration and high heat processes;
- Landfill;
- Export of waste; and
- Do – nothing.

These alternatives were comparatively evaluated using a set of criteria presented in the 2007 Working Paper. The evaluation identified increased waste diversion and landfill as the preferred alternatives for the City of Sault Ste. Marie. These alternatives have been supported through input received by the public to date.

It is noted that public input also supported incineration and high heat processes. A high heat process is incorporated in the City's overall waste management plan through the City's contractual relationship with a private sector Energy-from-Waste proponent, The Elementa Group (Elementa). The City has committed to supply a portion of the City's municipal solid waste for processing in Elementa's proposed steam reformation plant. The plant is scheduled to become operational in April, 2011.

The next steps for the City of Sault Ste. Marie include continuing to improve the current waste diversion system and identifying and evaluating alternative methods for landfill.

SOLID WASTE MANAGEMENT PLAN
ENVIRONMENTAL ASSESSMENT
ALTERNATIVES TO THE UNDERTAKING

TABLE OF CONTENTS

Page

TABLE OF CONTENTS i
LIST OF ABBREVIATIONS ii

1.0 INTRODUCTION AND BACKGROUND 1
1.1 Background 1
1.2 Overview of the City's Waste Management System 2
1.3 Residual Wastes to be Managed 5

2.0 ALTERNATIVES TO THE UNDERTAKING 6

2.1 Increased Waste Diversion 6
2.2 Incineration and High Heat Processes 8
2.2.1 Incineration (Combustion) 9
2.2.2 High Heat Processes (Gasification and/or Pyrolysis) 10
2.2.3 Products/In-feeds (Incineration and High Heat) 12
2.2.4 Emissions 13
2.2.5 Solid Residues 14
2.2.6 Refuse Derived Fuel 15
2.3 Landfill 16
2.4 Export of Waste Outside the Service Area 21
2.5 Do Nothing 22

3.0 "ALTERNATIVES TO" EVALUATION 23

3.1 Evaluation Criteria and Approach 23
3.2 "Alternatives To" Description and Ranking by Criterion 24
3.2.1 Compliance with Regulation and Policies 24
3.2.2 Environmental Acceptability 25
3.2.3 Ability of City to Implement the Alternative 26
3.2.4 Flexibility of the System 27
3.2.5 Capability of Managing Waste Quantities and Qualities 28
3.2.6 Proven Technician Capability 29
3.2.7 Economic/Cost 29
3.3 "Alternatives To" Evaluation Results 30

4.0 PUBLIC CONSULTATION PROGRAM 33

5.0 NEXT STEPS 38

LIST OF TABLES

Table 1 - Waste Requiring Disposal 5
Table 2 - Overview of High Heat Processes 11
Table 3 – Evaluation Criteria "Alternatives To" Evaluation 23
Table 4 – Evaluation Matrix "Alternatives To" Description and Ranking by Criterion 39
Table 5 – Summary of "Alternatives To" Ranking 31
Table 6 – Comments Received from Public on "Alternatives To" 34
Table 7 – Comment/Questions from the June 3rd Information Centre 35

LIST OF FIGURES

Figure 1 – Historical Residential Waste Diversion Rates for the City of Sault Ste. Marie 7
Figure 2 - Landfill Location 17
Figure 3 – Landfilled Waste Types 18

APPENDICES

Appendix A – Public Input Session Report, June 26, 2007
Appendix B – Open House Report, August 9, 2007
Appendix C – Public Information Centre Report, June 3, 2010
Appendix D – Garden River First Nation Band Council Meeting Report – June 8, 2010

LIST OF ABBREVIATIONS

EA	Environmental Assessment
EAA	Environmental Assessment Act
EFW	Energy–From-Waste
EU	European Union
GMEF	Green Municipal Enabling Fund
GRFN	Garden River First Nation
HSW	Household Special Waste
IC&I	Industrial, Commercial and Institutional
MBT	Mechanical Biological Treatment
MOE	Ministry of the Environment
RDF	Refuse Derived Fuel
ToR	Terms of Reference
WDO	Waste Diversion Ontario
WEEE	Waste Electric and Electronic Equipment

SOLID WASTE MANAGEMENT PLAN
ENVIRONMENTAL ASSESSMENT

ALTERNATIVES TO THE UNDERTAKING

1.0 INTRODUCTION AND BACKGROUND

The City of Sault Ste. Marie is developing a Solid Waste Management Plan to determine the preferred way to address the waste management needs within the existing service area comprising of the City of Sault Ste. Marie, Prince Township and Batchewana First Nation's Rankin Reserve over the next 20 to 40 years. The Solid Waste Management Plan will include opportunities for both waste diversion and waste disposal.

The City continues to investigate ways to divert waste from disposal by promoting and developing programs that support the 3R's hierarchy of reduce, reuse and then recycle (see Section 1.2).

The City has implemented programs to divert blue and yellow box recyclables, electronic waste, styrofoam, used tires, leaf and yard waste, metals and municipal hazardous waste and has complemented these programs with by-laws to encourage residents to divert waste.

In the Spring of 2005, an Environmental Assessment (EA) Terms of Reference (ToR) was prepared documenting the planning process to obtain EA approval for the disposal component of the Solid Waste Management Plan. The EA ToR was approved by the Ministry of the Environment (MOE) in September, 2005.

As outlined in the EA TOR, the environmental assessment includes an evaluation of "alternatives to" or functionally different ways of addressing the need for additional waste disposal capacity; and an evaluation of alternative methods which are different ways of doing the same activity (e.g. alternative locations or designs).

In June 2007, the "Alternatives to the Undertaking" Working Paper was released. This working paper described the "alternatives to" being considered for Sault Ste Marie as well as the criteria to be used to evaluate the alternatives and the data collected for each alternative.

Public input sessions were held in Sault Ste. Marie and Garden River First Nation on June 26, 2007 and August 9, 2007 respectively, to obtain feedback on the information contained in the working paper. Meetings were also held with the Batchewana First Nation Chief and staff, Missanabie Cree representatives and Metis Nation of Ontario representatives to present the information.

The results of the evaluation, including the public and stakeholder input received, is included in this report.

1.1 Background

In September 2000, the City initiated a four-phased Solid Waste Management planning process to provide direction on all aspects of solid waste management for the next 20 to 40 years. The plan was completed in four phases:

- Phase 1: Identification of a Preferred Waste Diversion System;
- Phase 2: Identification of a Preferred Waste Disposal System;
- Phase 3: Development of a Business and Implementation Plan; and

- Phase 4: Development of an Environmental Assessment Act Terms of Reference.

Phase 1 identified a need for expansion of the City of Sault Ste. Marie waste diversion programs and is documented in the *Alternative Waste Diversion/Collection Systems Options Report* (June 2001). Many of the recommendations have now been implemented and as a result , the City has increased from a residential diversion rate of approximately 9% in 1999 to 34% in 2009.

In addition, the City received funding through the Green Municipal Enabling Fund (GMEF) to undertake a feasibility study on co-composting residential organics and leaf and yard waste with municipal biosolids. The *Co-composting Pilot Study* report was finalized in February 2004.

An overview of the current waste diversion programs is provided in Section 1.2.

Phase 2 of the study was completed in July 2002 with the release of the *Waste Collection and Disposal Report*. In this phase, it was recognized that with the limited disposal capacity remaining in the City's landfill additional disposal capacity would be required in the future despite the significant efforts to enhance diversion. Within the report a number of disposal alternatives were explored and evaluated and public input on the disposal alternatives was obtained.

Phase 3 of the study was completed in February 2003 with the release of the *Business and Implementation Plan*. This plan outlines the costs of expanded waste diversion programs and waste disposal and explores options to recover those costs. The result of this report was that Council approved the implementation of a partial pay-as-you-throw program with residential bag/container limits, bag fees and increased gate and tipping fees at the landfill site. The City is committed to undertaking periodic updates to the Business and Implementation Plan to ensure it reflects program changes and adequate funds are budgeted to meet future requirements. An update has been initiated in 2010.

Phase 4 resulted in the preparation of an *Environmental Assessment Terms of Reference* (July 2005), a required first step in the preparation of a Waste Management Environmental Assessment.

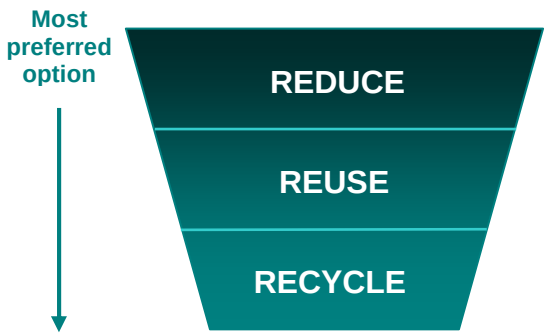
The above reports provide significant details regarding the background on the existing and future waste management system in the City. Public input was solicited in the preparation of these documents.

1.2 Overview of the City's Waste Management System

The population serviced through the City's waste management system is approximately 75,300 residents[1]. Waste management services for this population include a combination of waste diversion programs and disposal facilities. Waste is currently disposed in the City landfill site located north of Fifth Line East and west of Kings Highway 17. The City has completed a Waste Quantities Report (June 2010) which documents historical waste quantities and predicts future residual waste disposal quantities. Based on this report, the site life is projected to extend to approximately 2017.

[1] 2009 WDO Data Call

Over the past decade, the City has been very diligent to promote, develop and enhance waste diversion programs and services that support the 3R's hierarchy: reduce, reuse and recycle and has complemented these programs and services with by-laws to encourage residents to divert waste.



The City has been leading active campaigns to reduce the amount of waste that residents generate with initiatives such as the plastic shopping bags campaign. This initiative educates residents to reduce the amount of plastic bags generated and encourage them to shop with reusable shopping bags instead. The City is also currently pursuing an initiative where customers will receive a discount if they bring in their own refillable cup to City facilities such as arenas.

In efforts to reuse waste, the City promotes Habitat for Humanity's ReStore where residents and businesses can donate or purchase new and used household items and building materials such as windows, doors, paint, lumber, tools and lighting fixtures.

Some of the recycling programs in Sault Ste. Marie have been established and refined to manage materials designated by the Ontario Waste Diversion Act such as blue and yellow box recyclables, used tires, waste electrical and electronic equipment and municipal hazardous or special waste. These programs are supplemented by other programs that collect and recycle non-designated materials such as styrofoam and plastic grocery bags.

In addition, the City strongly encourages the business sector to comply with recycling mandates and implements strong programs in municipal facilities and at public events. The City also initiated a fluorescent light program that targets local businesses and the public to drop off bulbs to the Hazardous Waste Facility so they could be safely transported to a recycling facility.

An overview of the waste diversion programs is summarized below.

- The City offers an extensive curbside recycling program which services approximately 23,765 single family households[1]. In addition the program services approximately 9,943 multi-residential units[1]. Recyclables are separated, by residents, into "containers" and "fibres" and set out curbside with their waste for collection on a weekly basis. The management and operation of the curbside recyclables program may change from a Municipal responsibility to a Stewards responsibility in the future. This change will impact the Municipality's ability to influence the future curbside diversion rate. A decision on the future management and operation of this program is expected late in 2010.

- It is estimated that approximately 12,100[1] backyard composters have been distributed to residents in years past. The City also collects leaf and yard waste bi-weekly throughout the growing season (ie: late April to early November) and composts the feedstock in open windrows at the landfill site on Fifth Line. The final compost is used on City projects by the City's Parks and Recreation Department.

- The City has banned leaf and yard waste and old corrugated cardboard (OCC) from the landfill.

- The City has also established a permanent Household Special Waste Facility (HSW) at the Public Works yard. The facility has been operational since 2001 and has been effective in diverting household hazardous waste generated within Sault Ste. Marie and surrounding areas. This facility is owned an operated by the City of Sault Ste. Marie. It is anticipated that the program will be managed and operated by the Stewards commencing in the summer of 2010.

- The City has implemented a staged reduction in residential waste set out limits. The City introduced a 4 bag/container limit on January 1, 2004 which was reduced to 3 bags/containers on May 1, 2004 and 2 bags/containers on January 1, 2005. Tipping fees and gate fees at the landfill were most recently increased on January 1, 2006 to $65/tonne and $6/visit respectively. In conjunction with the gate fee increase the City reduced the permissible weight associated with the gate fee from 500 kg to 300 kg. The curbside waste set out limits, gate fee and tipping fee are currently under review in conjunction with the 2010 update to the Business and Implementation Plan.

- Separation and diversion of clean wood waste and brush, white goods, metals, propane tanks, tires, and batteries is also completed at the City's landfill.

- A diversion event is staged by Clean North (a citizens environmental group) on an annual basis to facilitate the diversion of Christmas trees.

- Habitat for Humanity has established a ReStore for the sale of reusable household items and construction and renovation materials.

- A Community Recycling Depot was established in 2008. The Depot is operated by Community Living Algoma and accepts a broad range of electronics and styrofoam. Some products are accepted free of charge and others are accepted for a nominal fee.

Through these programs, approximately 11,740 tonnes of residential material was diverted from disposal in 2009. This represents a residential diversion rate of 34%.

The City has also initiated a Biosolids Management Study. The objective of the study is to review alternative biosolids management strategies and develop a sustainable and effective strategy that reduces the impact on the City's landfill, more effectively manages nuisance odours, has wide public support, is cost effective and environmentally responsible. The Study is scheduled to be completed in 2010.

A private sector energy-from-waste (EFW) proponent called The Elementa Group (Elementa) has built and tested a pilot steam reformation plant that converts municipal solid waste into a char and synthetic gas that can be used to generate electricity. The pilot testing was completed from 2007 to 2009 and Elementa is now proceeding with the construction of a new larger-scale facility, with an

estimated annual throughput capacity of 35,000 tonnes. The City has entered into a waste supply agreement with Elementa to process a minimum 12,500 tonnes per year of the City's residential MSW for a minimum ten year period commencing in 2011.

1.3 Residual Wastes To Be Managed

A report entitled *Waste Quantity Projections and Existing Environmental Profile* was also prepared in June, 2010. This report estimated the future waste quantities requiring disposal within the service area over a 40-year planning period (2010 to 2049). The estimation of waste quantities takes into consideration population projections, residential waste generation and diversion rates, IC&I disposal rates and disposal requirements for municipal biosolids generated at waste water pollution control plants. Table 1 shows the range of waste, by sector, that requires disposal in 2010 and 2049.

Table 1
WASTE REQUIRING DISPOSAL

	Residential (tonnes per year)	IC&I (tonnes per year)	Biosolids[1] (tonnes per year)	TOTAL (tonnes per year)
2010	22,519	42,343	10,393	**75,255**
2049	26,409	52,061	0	**78,470**

1 – It is assumed that all municipal biosolids will be diverted commencing in 2016.

Over the 40-year study period, the City of Sault Ste. Marie would require additional disposal capacity of approximately 2.33 million tonnes.

2.0 ALTERNATIVES TO THE UNDERTAKING

The alternatives identified to address diminishing waste disposal capacity in Sault Ste. Marie were presented in the EA TOR approved by the Ministry of the Environment (MOE) in September 2005. The "alternatives to" that will be considered in the environmental assessment are as follows:

1. Increased Waste Diversion.
2. Incineration and High Heat Processes.
3. Landfill.
4. Export of Waste Outside the Service Area.
5. Do-Nothing.

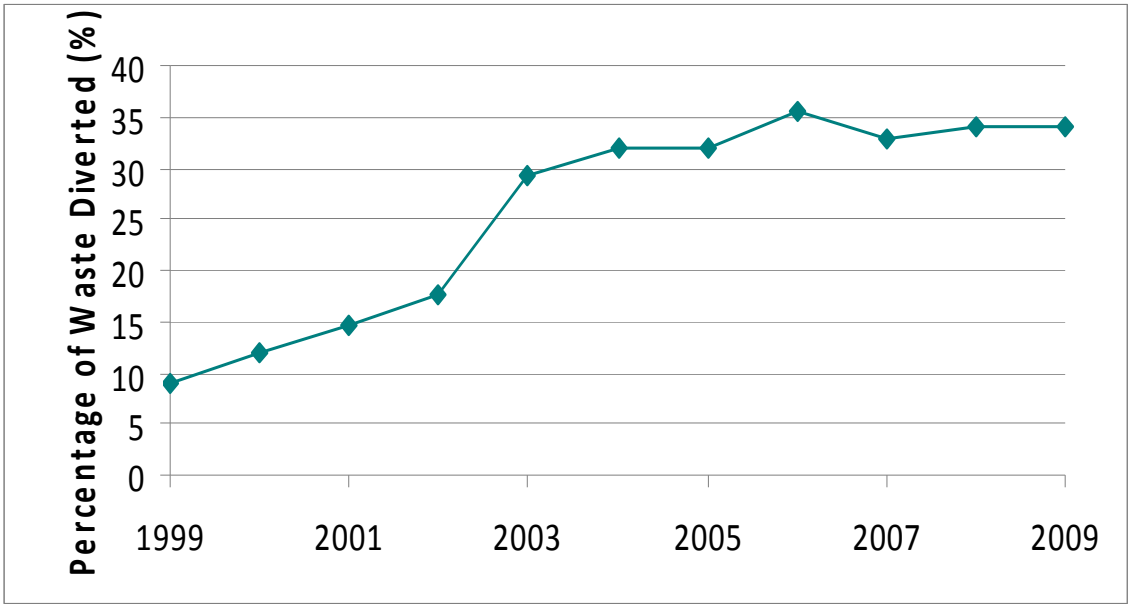
The following sections describe each "alternative to".

2.1 Increased Waste Diversion

The City of Sault Ste. Marie's waste diversion system currently includes initiatives to reduce and reuse waste (ie. plastic bags campaign, Habitat for Humanity ReStore, reusable coffee cups); collection and recycling of fibers and containers (ie. curbside yellow and blue box program); bi-weekly collection and composting of leaf and yard waste throughout the growing season; a household special waste depot; special events staged by Clean North; a Community Recycling Depot; landfill bans; and segregation and recycling of metals, batteries, white goods, tires, and clean wood and brush at the landfill. In 2006, the City limited residential waste setout to 2 bags/containers per week per household. Tags for additional waste bags or containers must be purchased.

The residential waste diversion programs diverted approximately 34% of residential waste from the landfill in 2009. This is a significant increase compared to the 9% diverted in 1999. ***Figure 1*** shows how diversion has been steadily increasing in Sault Ste. Marie over the past 10 years. The province has established a target of 60% residential diversion for larger municipalities (ie: populations exceeding 250,000). Medium sized municipalities such as Sault Ste. Marie could be given a lower interim waste diversion target, achieving 60% over a longer period of time. These targets are currently just a goal with no legal requirement for municipalities to meet the target. From an EA context, municipalities are encouraged to show progress on diversion that is appropriate for their size and location.

Figure 1 Historical Residential Waste Diversion Rate for the City of Sault Ste. Marie



The City collects recyclables from approximately 23,765 single family households and approximately 9,943 multi-residential units. There is limited ability to increase diversion by adding additional locations to the program.

The City is also working with the MOE, local service providers and the Industrial, Commercial and Institutional (IC&I) sector to encourage further diversion of IC&I waste from landfill. However waste management in this sector is managed privately and is not within the City of Sault Ste. Marie mandate. Extensive diversion is currently being achieved in the IC&I sector, when considering all sources of waste (e.g. forestry industry waste, construction and demolition waste, etc.), but is largely driven by market conditions for waste materials and by provincial policy and enforcement. The City will continue to encourage waste diversion efforts in this sector with the goal to sustain or improve current levels of diversion.

The *Increased Waste Diversion* alternative would potentially include increased capture efficiency through enhanced public education, enhancement of the existing residential blue/yellow box collection system by adding additional recyclable material, and collection and composting of household organics[2], and/or processing of sewage treatment plant sludge that is currently landfilled[3]. It is noted that even with aggressive diversion (ie. meeting the Provincial target of 60%), disposal is still required now and for the foreseeable future.

[2] The potential to implement a household organics program in Sault Ste. Marie has been considered in the waste management planning process completed to date. At this point in time the City has decided that feedstock restrictions, operating challenges and the cost of implementing a program outweighs the potential benefits. It may be that such a program becomes more feasible for Sault Ste. Marie within the 20-40 year planning period for this EA.

[3] The City of Sault Ste. Marie has commissioned a Biosolids Management Study. One of the key objectives of this study is to process municipal biosolids to support a beneficial use and eliminate disposal.

Consideration is currently being given to changes to Ontario's Waste Diversion Act (WDA) which is the legislation that governs the Blue Box program. The changes may involve adapting Extended Producer Responsibility programs which will transfer the management and operation of the curbside recycling program from municipalities to producers. This may impact the City's ability to enhance the level of diversion achieved through this program in the future. Details on the new Act are unknown at this time and will be reviewed once it is released later in 2010.

The approximate cost for increased diversion will vary depending on the diversion activity. Public education for example will cost less to implement than a full scale household organics program. The cost for household organics is anticipated to range from $45 to $170 per tonne for collection and processing depending on the technology used. The additional net cost (ie: after material revenue sharing and Waste Diversion Ontario (WDO) funding) of increased materials collected through the blue/yellow box program is anticipated to be in the range of $100 to $150/tonne (collection and processing).

2.2 Incineration and High Heat Processes

Incineration and high heat processes are not likely familiar to many individuals due to the limited number of full scale facilities presently operational in Ontario. A pilot scale high heat facility has been operational in Sault Ste. Marie for the last three years. In the following subsections information on various technologies is provided to assist the reader in gaining a better understanding of incineration and high heat processes. If incineration and high heat processes is identified as the preferred "alternative to", different technologies and locations will be considered in more detail in the next phase of the EA.

Incineration (combustion) and high heat processes (gasification, pyrolysis) include technologies where the organic materials in the waste stream are converted to thermal energy, carbon dioxide (CO_2) and water.

Depending on the specific nature of the incineration/high heat processes, typical input materials can include:

- mixed waste from curbside collection; or
- refuse derived fuel (RDF) consisting of the combustible fraction of the waste stream separated through mechanical and/or biological treatment processes.

Overall it is anticipated that approximately 49,000 to 56,000 tonnes per year (or 65% to 75% of the total residual waste stream) of residential and IC&I wastes would be suitable for incineration or high heat processes with the remainder being landfilled. However, these facilities are typically sized to accommodate the residual (ie: post diversion) residential wastes only as it is considered to be reliable and consistent over time. Cost (ie: tipping fee) is a key consideration for IC&I sector waste. The IC&I sector will not typically enter into long term contracts which precludes the sizing of plants for this waste. For Sault Ste. Marie, this would likely result in a further reduction in the quantity of waste to be processed through incineration or high heat processes. Given these constraints, an incinerator or high heat facility would typically be sized for some 20,000 to 24,000 tonnes of residential waste (or approximately 1/3 of the City's total residual waste stream).

Incineration (combustion) is a process whereby the organic materials in the waste stream are converted to thermal energy, carbon dioxide (CO_2) and water in either a single stage or two-stage process, and the exhaust gases from combustion are cleaned prior to being emitted to the atmosphere. Combustion processes operate in an excess air, oxidizing environment and they are exothermic requiring little to no external energy once combustion has been initiated.

Both gasification and pyrolysis technologies are considered high heat processes that convert hydrocarbons in the waste stream into a synthetic gas (syngas) within an oxygen starved (or in some cases an oxygen free) environment, which is normally followed by thermal oxidation of the synthetic gas. The principle difference between conventional incineration and gasification or pyrolysis is that with conventional incineration technologies, exhaust gases are cleaned up after combustion while with gasification technologies; the syngas is often cleaned up prior to its combustion.

Each of these technologies is described in greater detail in the following subsections.

2.2.1 Incineration (combustion)

Single-Stage Mass Burn

Single-stage combustion technology is well established. Waste is typically received in an enclosed tipping area and dumped into a receiving pit. The feed crane operator inspects the waste in the pit and any unacceptable materials are removed (typically 1% - 3% of the incoming waste stream). The waste is then fed via a grapple crane into the combustion chamber.

The combustion chamber is usually equipped with an inclined moving grate system where the material passes through the stages of drying, ignition, combustion and burn out as it travels down the grate. Air is added at various points in the chamber to optimize combustion in each stage of the process. Ash is discharged from the bottom of the grate and is quenched (i.e. cooled with water). Generally, each mass burn combustion chamber can process in the order of 150 to 800 tonnes of waste per day based on the design.

Flue gases generated inside the combustion chamber pass upward into a burnout zone, where the temperature is maintained at approximately 1,000° C. Modern combustion facilities employ air pollution control (APC) equipment to mitigate the plant emissions in the flue gases (see discussion below under Air Emissions). The flue gases then pass through a boiler and economizer. Steam is generated and can be used for heating and/or electricity production via a steam turbine.

There are no operating single-stage mass burn facilities in Ontario, however, this is the most common approach used in European nations and in the U.S.A. There is also a mass burn combustion facility working in Quebec City, Quebec, and one in Burnaby, BC. The Burnaby facility has been in operation since 1987 and has a capacity of 280,000 tonnes per year, or about 850 tonnes per day. This technology has also been selected for the proposed Durham-York facility being developed in Clarington.

Two-Stage Combustion

Two-stage units are generally modular units that are much smaller than single-stage mass burn units, and can process up to 100 tonnes per day of material. Facilities are constructed by assembling a number of modules on-site and plants often consist of a number of modular combustion units operating in parallel.

As these plants are smaller, waste may be received on a flat tipping floor, rather than in a pit. Waste is often loaded into the primary combustion chamber with a front-end loader. The waste is usually gasified in a starved-air condition, which leads to the formation of a combustible gas mixture (primarily hydrogen and carbon monoxide) and ash. The combustible gas mixture passes into a secondary chamber where it is fired with auxiliary fuel (if required) to complete combustion and to raise the temperature to approximately 1,000° C. As with all combustion technologies, steam produced in the boilers can be used for electricity production and/or heating.

The only currently operating Municipal Solid Waste (MSW) incinerator in Ontario is the privately owned and operated Algonquin Power facility located in Brampton that combusts waste managed by the Region of Peel. This facility is an example of a modular two-stage combustion facility. Typically these facilities have lower capital costs, are less energy efficient and have a shorter operating lifespan compared to single stage mass burn technology discussed above. Few new, two-stage combustion facilities have been developed in recent years.

The approximate net cost of conventional combustion processes at the scale required for Sault Ste. Marie would be in the range of $110 to $190 per tonne. This range is in line with other facilities including the Algonquin Power Facility which reportedly charges the Region of Peel in the order of $120 per tonne of waste received and the proposed Region of Durham facility which is estimated to cost $140 per tonne.

2.2.2 High Heat Processes (Gasification and/or Pyrolysis)

Gasification and/or pyrolysis processes involve the thermal conversion of solid organic materials into a gaseous constituent (syngas), a solid char residue, and in the case of pyrolysis, possibly a liquid fuel constituent. The processes differ from combustion in that they operate under a limited (or no) oxygen reducing environment (as opposed to an excess air, oxidizing environment) and they are endothermic (i.e., require external energy). This external energy is either provided by allowing a very limited amount of the volatiles in the feedstock to combust in a reactor (gasification), or heat is added from external sources in the absence of oxygen (pyrolysis). The effect is the same: volatiles in the feedstock are converted to syngas, which may be used for a variety of purposes, such as fuel or chemical feedstock.

Syngas consists primarily of hydrogen, carbon monoxide, carbon dioxide and nitrogen, and has a heating value of about one third that of natural gas. Generally, syngas is cleaned before it is utilized for the generation of heat. The syngas cleaning process is often a wet process that washes contaminants out of the syngas and that generates a small quantity of residue that must be managed as a hazardous waste. After cleaning, syngas can be used as fuel for reciprocating engines or gas turbines, or it can be combusted in a steam boiler to generate steam under utility

conditions (with good combustion control) the same way that natural gas is used. Syngas can also be used as a feedstock for the synthesis of chemical compounds. In practice, most facilities either use the syngas with limited or no cleaning for direct combustion into heat, or in reciprocating engines for the generation of electricity and (waste) heat.

Before gasification or pyrolysis can occur, the solid waste input is generally subjected to some pre-processing (mechanical treatment). Depending on individual thermal process requirements, this can range from coarse processing and sorting, to elaborate front-end processing involving fine processing, drying, recyclable material recovery and mechanical sorting to produce a homogenous solid recovered fuel product. Biological treatment may also be used, generally to dry the material using the heat from the biological decomposition to dry input material.

There are a variety of gasification and pyrolysis technologies available, many of these at the pilot or demonstration scale of commercialization. There are several fully commercialized technologies currently operating, primarily in Japan. Currently, a pilot/demonstration facility is operating in Ottawa that uses a Plasma gasification approach to process MSW and other waste derived fuels. This is the first such high heat process constructed in Ontario. The Elementa Group pilot scale demonstration facility in Sault Ste. Marie is a form of gasification, in which syngas is formed through the chemical breakdown of materials under high temperatures in an oxygen-free environment. An overview of various high heat approaches is provided in ***Table 2***. It is noted that this information on various technologies is provided for the reader's information to better understand incineration and high heat processes.

Table 2
OVERVIEW OF HIGH HEAT PROCESSES

Technology	Reactor Conditions	Products / Residuals	Key Features
Pyrolysis	400° to 900° Celsius Indirect heat source Absence of free oxygen	Volatile carbons converted to Syngas Solid Non-hazardous Carbon char and/or ash requiring disposal Small quantity of hazardous waste Metals recovered for recycling	Less carbon converted to syngas than gasification approach
Conventional Gasification (Fixed or Fluidized Bed)	760° to 1650° Celsius Direct heat source Limited Oxygen	Volatile carbons converted to Syngas Solid Non-hazardous Ash/slag requiring disposal	More carbon converted to syngas than pyrolysis

Table 2 OVERVIEW OF HIGH HEAT PROCESSES			
Technology	**Reactor Conditions**	**Products / Residuals**	**Key Features**
		Small quantity of hazardous waste	
Plasma Gasification	Plasma arc used to create high temperature stream of ions (plasma) Plasma used to heat MSW to 1100° to 1650° Celsius Limited Oxygen	Volatile carbons converted to Syngas Vitrified slag that could potentially be used as aggregate provided regulatory approvals obtained. Small quantity of hazardous waste possible, depending on process – may be made non-hazardous by melting it into a glass-like material.	High heat creates a vitrified slag material that binds all hazardous constituents. More carbon converted to syngas then pyrolysis and conventional gasification.

The approximate net cost of high heat processes is expected to be the same or higher than conventional combustion. This is because the process usually requires waste pre-processing, which is complex and costly; a high degree of process control, especially when employing high heat plasma technology; and syngas clean up. Combined, these components make gasification and pyrolysis fairly complex systems.

There are no operating full scale commercial gasification or pyrolysis facilities in North America. There are several in Japan, and a few in Germany.

It is noted that new technologies that are in their infancy may be able to access grants and other incentives which can reduce the net cost per tonne and may not reflect the true lifecycle costs of operating high heat process facilities.

2.2.3 Products/In-feeds (Incineration and High Heat)

The products from a thermal treatment process include:

- Assuming an energy generating component is incorporated in the facility, electrical energy in the form of electricity production and/or thermal energy in the form of heat/steam. Note: in accordance with the Municipal Waste Integration Network (MWIN)/Recycling Council of Alberta study regarding the integration of organics management and residual treatment/disposal, the average energy recovery (electricity only) for small scale disposal facilities ranges from 450 to 500 kWh/tonne for energy from waste facilities compared to 136 to 160 tonne for landfill sites with landfill gas recovery (low end of the range if communities have source separated organics (SSO)

diversion programs). Vendors of some new technologies claim they can produce at least twice this energy per tonne.

- Various mechanical treatment processes (magnetic separation, screening) can be utilized to extract recyclables from the bottom ash or char derived from the thermal treatment process. Potentially recoverable recyclables include ferrous metals, non-ferrous metals and possibly a processed bottom ash material for use in construction aggregates (such as granular "B").
- Incineration typically produces a non-hazardous bottom ash, while gasification usually produces a non-hazardous char (which contains a higher carbon content than bottom ash) that following processing and recovery of recyclables, requires landfill disposal. The ash or char contains solid residue from combustion and residues such as glass that are both non-combustible and non-recyclable.
- The process used to clean exhaust gases for incinerators generates a small quantity of residue that must be treated/managed as a hazardous waste, generally in the order of 4 percent by weight of the incoming fuel. The wet process used to clean the syngas in gasification/pyrolysis processes, generally produces a small quantity of sludge that also must be treated/managed as a hazardous waste. (refer to Sections 2.2.4 and 2.2.5)

2.2.4 Emissions

Air emissions released from incineration arise from the compounds present in the waste stream, and are formed as a normal part of the combustion process. Emissions can also be expected, in the case of gasification/pyrolysis, when the syngas is subsequently combusted to produce electrical and/or thermal energy. Modern thermal processing facilities employ air pollution control systems and syngas clean-up processes to reduce air emissions that are released.

The Ontario Ministry of the Environment (MOE) has addressed air emissions from thermal facilities in Ontario in Guideline A-7. Guideline A-7 sets air emission limits for particulate matter, acid gases, metals and dioxins/furans and establishes requirements for their control, monitoring and air pollution control system performance testing. Although, the emissions criteria specified in Guideline A-7 are very stringent and comparable with the latest regulations governing emissions from facilities in both the United States and Europe, the MOE expects that air emissions for new facilities will be significantly below limits in Guideline A-7.

The various combustion and gasification/pyrolysis technologies have differing emission levels, however they are generally comparable. What differs between the two approaches is how the emissions are controlled.

For combustion processes, depending on the specific thermal technology employed, emissions are controlled by directing the exhaust gases through an air pollution control system that may include:

- Electrostatic precipitators to remove particulate matter;
- Lime slurry scrubbers or dry lime scrubbers, to control acid gases such as oxides of sulphur (SOx), and hydrochlorides (HCl);
- Other wet scrubbers to remove other contaminants;

- Urea injection in the post-combustion flue gases commonly known as a Selective Non-Catalytic Reduction (SNCR) process or a Selective Catalytic Reactor (SCR) process, for reduction of nitrogen oxide (NO_x) emissions;
- Powdered activated carbon (PAC) system to control mercury and dioxins/furans; and
- A high-efficiency fabric filter or bag house to remove particulate matter.

The cleaned exhaust gases are then discharged to the atmosphere via a stack.

For gasification/pyrolysis processes that include a syngas clean-up step, the syngas is quenched and washed using scrubbers prior to combustion (wastewater from the scrubbers may require treatment prior to discharge). If the syngas is cleaned prior to its combustion, a separate air pollution control system for the combustion gases is generally not required to meet air emission standards. If the syngas is not cleaned prior to combustion, then the part of the process where the syngas is combusted generally requires air pollution controls similar to that described above for regular combustion processes.

2.2.5 Solid Residues

As gasification/pyrolysis systems often involve pre-processing to better prepare the material for the gasification/pyrolysis process, residuals requiring landfill disposal include rejects from front-end processing (such as grit and broken glass) as well as by-products from the syngas and/or fluegas cleaning process. These gas clean-up residues can include particulate removed by a cyclone and sludges recovered from wet gas scrubbers. Some gasification/pyrolysis technologies offer a vitrification process that melts the residual inerts into a glass-like slag that is considered inert, and could be used as construction aggregate (if it is accepted by regulators and the marketplace). As there are no Ontario examples of such processes, it is difficult to determine if the use of this slag as a construction aggregate would be accepted by the Province. In countries like Japan, which have very strict criteria for processing ash, vitrified slag is considered acceptable as construction material, since all contaminants are permanently bound in the glass like matrix of the material.

The solid material removed by the air pollution control system (referred to as fly ash) is classified as a hazardous waste due to the presence of the metals removed from the exhaust gases. It must be either treated to render it non-hazardous, using proprietary processes such as the Wheelabrator “Wes Phix”system (that chemically transforms the heavy metals in the fly ash into less soluble compounds thus reducing leachability) or disposed in a secure (hazardous waste) landfill such as the Clean Harbours facility near Sarnia.

In some jurisdictions, the grit such as broken glass and small stones screened out from mechanical and biological treatment processes along with the processed ash or char from thermal treatment processes are used as construction material. In practice, a portion of this material could be blended with other aggregate material to produce a waste-amended granular “B” product. It is important to note that the majority of metals in the ash/char must be removed prior to using this material as aggregate. In Ontario under current market and regulatory conditions, such a product would have a low value and high product risk due to technical concerns about its performance as an

engineered material and perceived risks of potential environmental contamination. These constraints make such materials very difficult to market in Ontario. On the other hand, it is possible through lab tests and field trials to establish the performance and safety of waste-amended construction materials.

In Europe it is a far more common practice to use the grit and ash/char derived from waste treatment as an aggregate material, and this material has an established market value and technical support for a range of aggregate applications. Key to the use of ash/char as aggregate is the removal of metals from the ash, and allowing the ash to 'age' for a period (generally 6 months) which allows for remaining heavy metals in the ash to be chemically bound so that they can no longer leach from the ash material, and the pH of the ash to neutralize.

In Ontario, the Ministry of the Environment will lift the "waste classification" if materials are fully utilized as viable products without further processing and provided that their use does not involve their direct application to land. For example, the Region of Peel in consultation with the MOE has been testing the performance of ash-amended asphalt for several years.

2.2.6 Refuse Derived Fuel

Various mechanical and biological treatment (MBT) processes can recover materials including plastics, fibre, wood and dried organic matter for use as refuse derived fuel (RDF). These materials can be in the form of pellets, bales or shredded materials. From a technical and economic perspective, the potential off-site markets for these fuels are cement kilns, utility boilers and greenhouse heaters where the recovered fuel can substitute for a portion of the petroleum coke, coal or other fuel that is presently used.

The case has been made that these recovered fuels contain fewer contaminants, such as sulphur, than the coal that they would displace, thus providing a potential net improvement to the air emissions at the existing facilities where they would be used. In Ontario, these fuels are currently classified as a "waste" and in order to use them, the cement kiln or power plant would have to be approved to dispose of this waste. To obtain such an approval, the owners of the facility would have to obtain approval under the Environmental Protection Act (EPA) and may have to undertake an Environmental Screening process under the Environmental Assessment Act (EAA) depending on the scale of the proposal. There are no approved industrial markets for RDF in Ontario as of yet.

For RDF to be viable as a primary management solution for the post diversion waste, a market for the material would have to become available. A local steel mill has recently completed the construction of a plant that uses industrial by-products from their own operations for the purpose of energy generation. Another local industry is also proposing to use biomass as a feedstock to generate energy. There could be some potential for interest by these or other local industries in also using an RDF, generated through the processing of Sault Ste. Marie's residual waste.

The combustion of RDF by industrial facilities or existing power plants is a different application of thermal approaches to waste management and not the same as incineration/gasification. Firstly, rather than introducing a new source of air emissions into the province, the RDF is being used as a substitute for other non-renewable fuels such as pet-coke or coal at existing facilities. Given that

a portion of the RDF is derived from biogenic sources, there is a net benefit to the environment in terms of greenhouse gas (GHG) emission reductions. Also, RDF often burns a lot cleaner than coal with reduced emissions for most major parameters except metals. RDF applications in industrial processes, often recover a significantly larger quantity of energy from the waste (60% versus up to 30% recovered through typical incinerators that generate electricity only) based on the use of heat generated from RDF combustion. Some processes (such as RDF use in cement kilns) do not generate any solid residue as the ash is incorporated into the product, further reducing landfill disposal requirements. If there is a substantial portion of PVC plastics in the RDF, combustion will create hydrochloric acid, which will quickly destroy industrial boilers not suitably equipped to work in this acidic environment.

The cost of producing RDF ranges widely, depending on whether a lightly sorted and coarsely shredded material, or a high-end dried and pelletized fuel is produced. The lower end of the RDF costs could be in the $65 per tonne range, and with pelletizing and drying the cost could easily double. These are very rough estimates based on research conducted for various clients in Canada. York Region currently sends a portion of their waste to a pellet plant in Vaughan, Ontario and pays $115 per tonne for transfer, hauling and disposal.

2.3 Landfill

Currently, waste from Sault Ste Marie, Prince Township and Batchewana First Nation's Rankin Reserve is disposed of at the Municipal Landfill located at 402 Fifth Line East (***Figure 2***). This site was developed in the 1960's by Cherokee Construction and acquired by the City in 1989. The site is operated by the City of Sault Ste Marie.

The existing site is licensed for the use and operation of a 44.6 ha (110.2 acre) fill area within a total site area of 83.6 ha (206.4 acres). The site is licensed to accept domestic, commercial, non-hazardous industrial waste and processed organic waste. Approximately 73,500 tonnes of material were received at the landfill in 2009 of which about 59,400 tonnes was landfilled, 9,900 tonnes were soil materials that was used as cover or stockpiled for future use as cover and 4,200 tonnes were diverted from the site. Other activities at the landfill include:

- Blue and Yellow Box recycling area;
- Leaf and yard waste compost area
- Metals recycling area;
- Propane tanks recycling area;
- Tire recycling area; and
- Wood waste recycling area.

Figure 3 provides a breakdown of the materials that were managed at the landfill site in 2009.

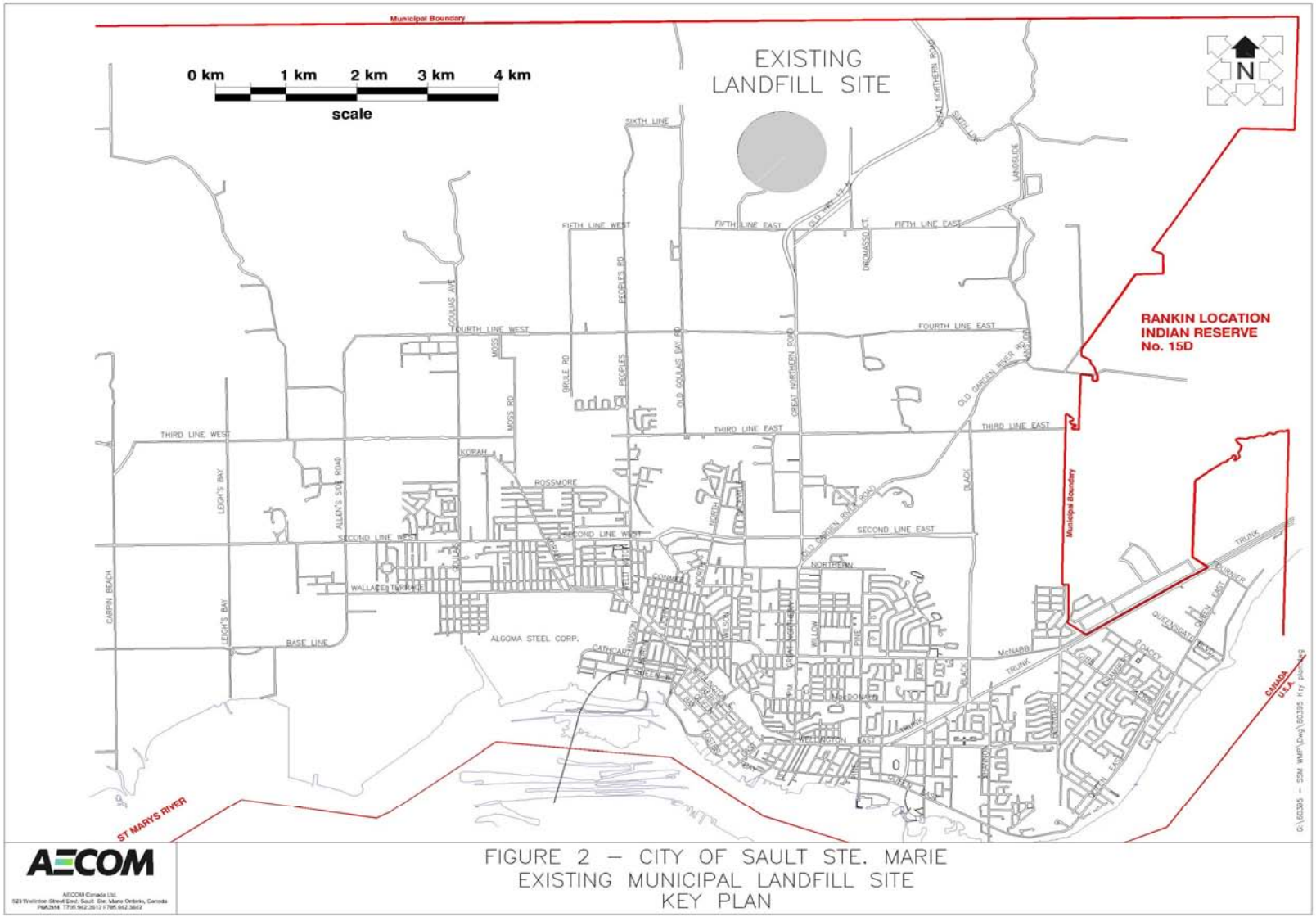
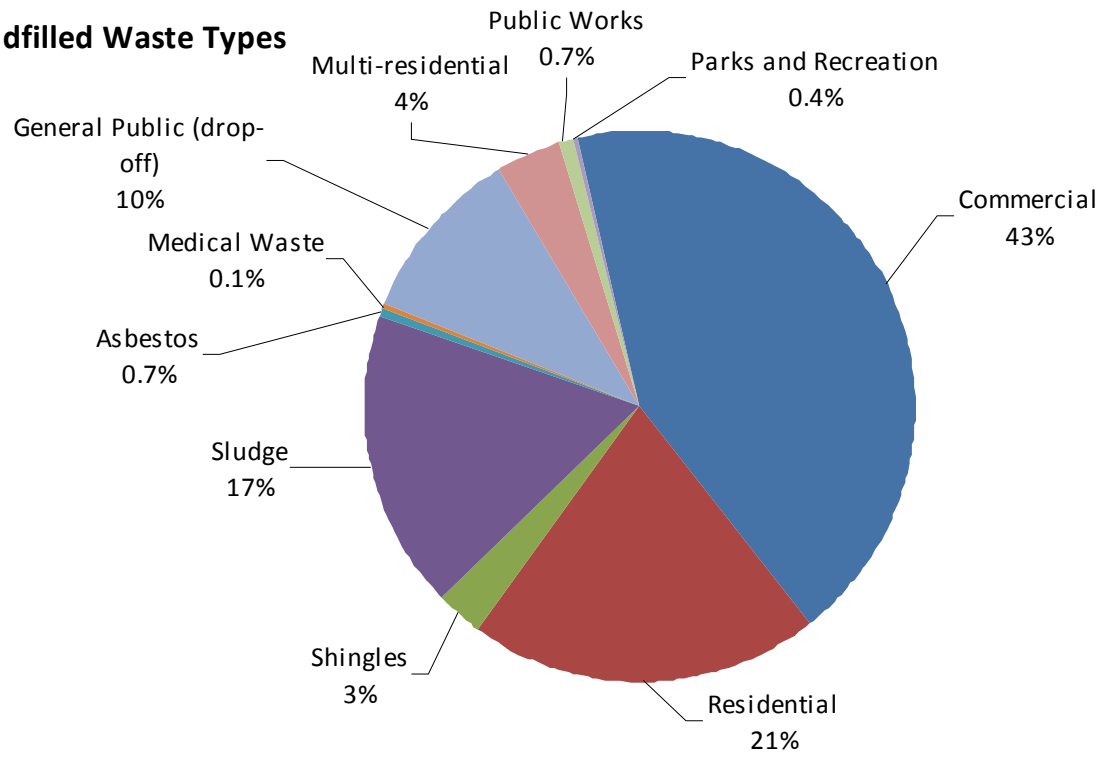

Municipal Boundary
0 km 1 km 2 km 3 km 4 km
scale
EXISTING
LANDFILL SITE
N
RANKIN LOCATION
INDIAN RESERVE
No. 15D
Municipal Boundary
SIXTH LINE
FIFTH LINE WEST
FIFTH LINE EAST
FOURTH LINE WEST
FOURTH LINE EAST
THIRD LINE WEST
THIRD LINE EAST
SECOND LINE WEST
SECOND LINE EAST
BASE LINE
GREAT NORTHERN ROAD
OLD GARDEN RIVER ROAD
PEOPLES RD
MOSS RD
BRULE RD
OLD GOULAIS BAY RD
GOULAIS AVE
ALLEN'S SIDE ROAD
LEIGH'S BAY
CARBIN REACH
ROSSMORE
KORAH
WALLACE TERRACE
ALGOMA STEEL CORP.
NORTHERN
McNABB
TRUNK
QUEENSGATE
ONONAGUSSE CT
LANDSLIDE
ST MARYS RIVER
CANADA
U.S.A.
AECOM
FIGURE 2 – CITY OF SAULT STE. MARIE
EXISTING MUNICIPAL LANDFILL SITE
KEY PLAN

Figure 3 - Landfilled Waste Types



The site is an engineered landfill site which includes collection of leachate at the south, east and west sides of the site. Leachate is collected via collection pipes and a series of purge wells. The leachate is pumped to the City's sanitary sewer system for treatment at the West End Water Pollution Control Plant. The annual volume of leachate managed was approximately 366,000 m^3 in 2009. Passive gas wells that are equipped with individual flares were installed to control landfill gas throughout the north-eastern portion of the landfill mass. The passive system is currently being upgraded to an active collection system and the collection area is being expanded throughout the eastern portion of the landfill. The collected gas will be burned in a central enclosed flare. Once the gas quality and quantity has been confirmed, through system operations over a period of months, it is anticipated that collected gas will be used for energy generation.

In December 1990, the City prepared a Design and Operations Report which included a plan for landfill development including final contours for the completed facility. Each year a Site Development and Operations Report is prepared to track landfill development and to confirm how much capacity remains in the landfill. The 2008-2009 Site Development and Operations Report shows approximately 832,000 m^3 of disposal capacity (refuse and daily cover) remaining as of November, 2009. The site life is projected to extend to 2017 based on future disposal rates and projected population growths.

This "alternative to" involves creating new landfill disposal capacity for the City's waste through either the expansion of the existing landfill site or the development of a new landfill site.

Landfill expansion typically involves adding more waste on top of an existing waste fill area (vertical expansion) or increasing the size of the area where waste is deposited (horizontal expansion).

A new landfill could be a natural attenuation site (relying on natural protection) or an engineered site with a leachate collection system. In recent years, the majority of applications for larger new or expanded landfills have included engineered facilities. For the purposes of this EA an engineered site has been assumed in the evaluations.

Landfill mining could also be considered as a method of landfill expansion. This involves the excavation of the existing fill areas, the on-site processing of the excavated material to separate the material into different streams and recover material that can be used. Typically the excavated landfill material can be separated into three streams: soil (from cover material), metals and other recyclables and residual waste. The processing of the excavated wastes typically involves a combination of shredding, screens and magnets. Metals can then be recycled and soils used for future landfill cover. Residual materials can be landfilled or used as fuel for energy-from-waste facilities. The quantity of soils recovered can range significantly and the quantity of metals or other materials that can be recovered depends on what has been landfilled and the extent of degradation. The City undertook a pilot landfill mining project at the existing landfill site between September 1 and November 31, 1998[4]. The soil quantity recovered during this time represented approximately 60% of the volume. The cost of a full scale landfill mining operation could be in the range of $35 to $45/tonne. Odours can often be a significant concern during landfill mining operations. The extent of odours would largely be a function of the waste types that are excavated. Organic type wastes could generate foul odours. The construction of the

[4] Information about the landfill mining pilot was taken from the Waste Collection and Disposal Report, 2003.

active landfill gas collection system will also create some challenges in implementing landfill mining through the eastern portion of the site.

Modern landfilling is a highly engineered method of disposing of solid wastes on land in a manner that minimizes environmental effects. Landfills are designed, built and operated to minimize impacts on groundwater, surface water and air quality, and must meet strict provincial standards. An engineered landfill would typically include a liner, leachate management system and a landfill gas management system. Landfill gas could be burned to create electricity (green power). The recovery of energy will likely be cost efficient based on the projected disposal capacity requirements, however a revenue neutral position has been assumed in the economic analysis of this alternative. Landfills, once closed are covered with soil and vegetated. They are monitored, not only throughout their operating life, but also for decades after closure to ensure environmental protection is sustained.

Although a landfill is designed to fit into the local landscape as much as possible, there are still potential effects to neighbours such as noise, dust, odours, visual intrusion and various forms of traffic. To minimize these effects, mitigation measures are put in place such as compacting and covering waste with soil to control odour, litter and pests; maintenance of access routes to reduce safety concerns; and visual screening.

Landfills are a flexible waste management alternative in that any changes to the waste stream as a result of increased 3Rs, or population fluctuation will not have a serious impact on the operation of the landfill, only the length of time that it will last. They also provide a means of managing solid residual wastes that are generated or cannot be input into high heat or incineration processes.

The capital and operating costs of landfilling can vary depending on a number of factors including landfill size, the level of engineered features used, and the number of landfills in a system. Compared to incinerators and high heat processes, landfills require lower upfront capital costs and have lower operating costs.

In 2003 the City developed a *Solid Waste Management Plan Business and Implementation Plan.* The Plan was developed to provide City Staff and Council with guidance in preparing for future expenditures required to establish additional waste disposal capacity, implement new or expanded diversion programs and manage environmental controls at the existing landfill site.

Tipping fees and gate fees, or the cost charged to those wishing to dispose of waste at the landfill, are intended to cover, in whole or in part, all facility costs including salaries, benefits, city equipment, leachate management, landfill monitoring, supplies, grant in lieu of taxes, utilities, miscellaneous equipment, road maintenance and building and grounds maintenance as well as other costs such as soft costs (eg. approvals), site development, reserves for future capital improvements and site closure and long term monitoring. Thus, the tipping fee is typically a good representation of lifecycle costs. The 2010 tipping fee at the landfill was $65/tonne. The City also has a gate fee of $6.00 per vehicle for residential waste loads of less than 300 kg. The City is committed to reviewing the tipping fee structure periodically. The Waste Management Business and Implementation Plan is currently being updated which may impact the recommended tipping fee structure.

In the 2003 plan, a lifecycle cost estimate was also developed for a new 2.0 million tonne per year landfill (approximate site life of 25 years). The analysis identified that a tipping fee in the range of $65/tonne should be adequate to cover the lifecycle costs of the facility.

The approximate cost of landfilling is expected to be in the range of $70 to $80 per tonne which assumes a revenue neutral position relating to the sale of electricity and allows for expansion of an existing site or the development of a new site.

2.4 Export of Waste Outside the Service Area

The export of industrial, commercial and institutional (IC&I) waste to a disposal facility outside of the municipality in which it was generated has been occurring for a number of years in Ontario. More recently, the export of municipal-controlled waste (primarily residential) has been taking place, for example in most municipalities in the Greater Toronto Area (GTA). Some of the IC&I sector waste from Sault Ste. Marie currently goes for disposal in northern Michigan. The quantity of waste currently being disposed of in Michigan is unknown but is estimated to be in the range of 2,000 to 4,000 tonnes per year.

However, not all exported municipal-controlled waste goes to the US. Some is transported to private sector landfill sites in Ontario. For example, the Region of York sends some of their waste to a private landfill site near London, owned by the City of Toronto.

Over the past number of years there has been a growing view in Ontario that the need for waste disposal should be handled within the Province. As an example, in August 2006, an agreement was reached between the Ministry of the Environment and Michigan to eliminate the export of residential waste to Michigan by December 31, 2010. This agreement was focused on southern Ontario municipal waste and did not address IC&I waste but does indicate a continued push toward no export of Ontario's waste to the US. In June, 2007, the Ministry of the Environment released, for consultation, a Policy Statement on Waste Management Planning. One of the principles in this Policy Statement is "waste should be managed as close to the source of generation as possible".

There are also long term liability concerns associated with the impacts of waste on the environment. These liabilities are often referred to as "cradle-to-grave" and reflect the impacts the waste may have on the environment from the time it is disposed to the end of its contaminating lifespan. This is particularly significant with municipally-controlled exported waste because the municipality would not manage the environmental controls at the disposal facility but could be held responsible for long term impacts associated with any MSW disposed.

For Sault Ste Marie, the closest operating private[5] disposal facilities are in Michigan State and Espanola. The Michigan State site is approximately 30 km from Sault Ste. Marie and requires crossing of the border. The Dodge Landfill in Espanola is approximately 240 km from Sault Ste. Marie. An EA was approved to expand this site to a total capacity (including capacity already approved) of approximately 1,670,000 tonnes. If waste from the Sault was added to this site, it would reduce the site life of the Dodge Landfill or an additional expansion could be required.

[5] Only private sites have been considered as municipal landfills are typically licensed to receive only their own waste.

The export of waste generally requires a transfer station(s) in the municipality in which the waste is generated. The waste is loaded on large transport vehicles to be taken to the final disposal site. The disposal site must be certified to take the waste, and meet all environmental standards and regulations in the jurisdiction where the site is located. Transfer stations can result in noise and dust and truck related impacts on local roads. The significance of these impacts depends on the location of the transfer station(s) and its proximity to sensitive community uses or natural environment features.

The added environmental effects of export versus local disposal relate to operations at the transfer station, fuel consumption and air emissions of haulage, wear and tear on roads, disruption effects to local residents and users of the haul routes. It is anticipated that for this alternative, waste would be hauled mostly along highways.

The economic impact is the added cost of a transfer station and hauling waste; disposal cost remains whether done locally or remotely. The cost of export depends on where the waste is exported. Tipping fees would have to be negotiated with the landfill owner and are typically dependent upon the term of the contract and quantities to be disposed of. Longer term contracts and increased waste quantities typically result in lower per tonne costs for disposal.

The approximate cost of export is expected to be in the range of $85 to $105 per tonne. This estimate has been developed based on a $75 per tonne tipping fee combined with the construction and operation of a transfer station and a waste haul within a one hour travel distance.

2.5 Do-Nothing

It is common practice in an EA process to include the “do-nothing” alternative as a base case. This alternative identifies what would happen if Sault Ste. Marie did nothing to respond to its future waste disposal needs.

Based on the 2008-2009 Site Development Report, there is approximately 832,000 m^3 of disposal capacity (refuse and daily cover) remaining as of November, 2009. Based on the Waste Quantity Projections and Existing Environment Profile Report, the site life is projected to extend to 2017 based on future disposal rates. The “do-nothing” alternative would mean that by approximately 2017 the City of Sault Ste. Marie landfill would be at capacity and the City would no longer be able to fulfil their mandate to provide residential waste disposal capacity.

3.0 "ALTERNATIVES TO" EVALUATION

The identification and evaluation of "alternatives to" was carried out at a general level. Specific locations and technologies for these alternatives were not included.

3.1 Evaluation Criteria and Approach

Table 3 presents the criteria used for the evaluation of "alternatives to". These criteria were included in the approved EA Terms of Reference. A working paper including the proposed criteria was released in June 2007. A public input session was held on June 26, 2007 in Sault Ste. Marie and an open house was staged on August 9, 2007 in Garden River First Nation. The public input session and open house are documented in the Public Input Session Report and Open House Report which are included as Appendices to this report. No changes to the evaluation criteria were suggested as a result of public input.

Table 3
EVALUATION CRITERIA – "ALTERNATIVES TO" EVALUATION

Criterion	Definition
Compliance with Regulations and Policies	Addresses the ability of the "alternative to" to meet all applicable regulations and policies that affect the planning, design, construction, operation and decommissioning of the alternative.
Environmental Acceptability	Addresses the potential for environmental effects associated with the alternative and the ability of the "alternative to" to be approved as an environmentally acceptable option. It represents both natural environment and social/cultural considerations.
Ability of City to Implement the Alternative	Considers whether the City has the ability and mandate to implement the alternative.
Flexibility of the System	Considers whether the alternative could respond to changes in the waste stream that could come about as a result of such things as increased diversion, changes in the economy and product packaging or fluctuations in waste quantities and types.
Capability of Managing Waste Quantities and Qualities	Considers whether the alternative could handle the identified waste stream.
Proven Technical Capability	Considers whether the alternative has been proven through approval of similar facilities and years of successful operating experience in Ontario and other jurisdictions.
Economic/Cost	Considers the lifecycle cost of the alternative.

To evaluate the "Alternatives To", each of the alternatives was described based on the evaluation criteria noted in Table 3. This information was presented in the working paper and discussed at the public input sessions. No changes were made to the descriptions as a result of the input received at the sessions.

Using the descriptions created, the alternatives were ranked from most preferred (rank of first) to least preferred (rank of fifth) for each of the criteria. The rankings by criterion were then assessed to determine an overall preferred alternative.

3.2 "Alternatives To" Description and Ranking by Criterion

The following describes the alternatives based on the evaluation criteria noted in Section 3.1. ***Table 4*** (at the end of the text) provides this information in a table format. Included in the description is a discussion on the comparative ranking for each alternative. The rankings are also provided in the table.

3.2.1 Compliance with Regulations and Policies

This criterion is intended to address the ability of each of the alternatives to meet applicable regulations and policies that affect the planning, design, construction, operation and decommissioning of the alternative.

The alternatives *increased waste diversion, incineration/high heat processes, landfill* and *export* would all be able to be planned, designed, constructed, operated and decommissioned to meet applicable government policies and regulations. However, it is noted that the province has agreed with Michigan to eliminate residential waste export by December 31, 2010.

Landfills, incinerators/high heat processes and *diversion* facilities (recycling or composting plants) all require Certificates of Approval (C of A) from the Ministry of the Environment to operate. These C of As ensure that the facility meets the requirements of the *Environmental Protection Act* (EPA). In addition, *landfills* and *incinerators/high heat processes* require approval under the *Environmental Assessment Act* (EAA).

In March 2007, a new Regulation, Waste Management Projects (O. Reg. 101/07), under the Environmental Assessment Act was enacted. This regulation identifies projects that:

- Are subject to individual environmental assessments (EAs). The types of facilities that are subject to individual EAs include landfills greater than 100,000 cubic metres and thermal facilities that do not recover energy;
- Have predictable environmental effects that can be readily mitigated and thus are exempt from individual EAs if they fulfill an ***Environmental Screening Process***. The types of facilities that fall into this category include thermal facilities with energy recovery, industrial facilities that use more than 100 tonnes/day of waste as fuel and small scale landfills or landfill expansions of less than 100,000 cubic metres; and
- Are exempt from all EA requirements. The types of facilities that are exempt from all EA requirements include processing and transfer facilities where less than 1,000 tonnes per day of material is sent to final disposal.

Based on past experience in Sault Ste. Marie and the experience in other Ontario municipalities, applicable EAA and EPA approval can be obtained. It is also anticipated that technical approvals for incineration/high heat processes may be more involved and time consuming given the limited experience with these types of facilities in Ontario.

In June 2004, the Ministry of the Environment announced an overall residential diversion target of 60% by 2008 for municipalities with populations exceeding 250,000. Medium sized municipalities such as Sault Ste. Marie could be given a lower interim waste diversion target, achieving 60% over a longer period of time. This has not been adopted into official Ministry policy however. The City of Sault Ste. Marie has been very proactive and has increased residential diversion significantly from about 9% in 1999 to approximately 34% in 2009. Increased diversion could potentially meet the provincial diversion target in the future but the diversion programs would have to be expanded to include a full scale source separated organics program (refer also to Section 2.1).

The alternatives *increased waste diversion, incineration/high heat processes, and landfill* were all ranked as preferred or first for this criterion.

Export would only be undertaken if it were to a facility approved in whatever jurisdiction it was located. It is also noted that the province has agreed to cease residential waste export to Michigan by December 31, 2010. Export is ranked as fourth for this criterion.

The *do-nothing* alternative does not require the construction or operation of any facility; however, the do-nothing alternative would lead to closure of the municipal landfill and would not meet the City's mandate to provide disposal capacity. Thus, the do-nothing alternative is considered least preferred (ranked fifth) for this criterion.

3.2.2 Environmental Acceptability

This criterion compares the alternatives based on their potential for environmental effects. A broad definition of "environment" is included in the Environmental Assessment Act (EAA) which encompasses both the natural environment (e.g. potential for loss of habitat, impact on air quality, impact on surface and ground water, etc.) and the social environment (e.g. potential for negative impacts on people, communities or businesses).

Increased waste diversion, landfill, incineration/high heat processes and *export* all can be environmentally acceptable but have the potential to result in natural and social impacts such as air quality effects, surface and ground water effects, noise, dust, odour and truck traffic. The extent to which these are issues depends on the location of the facility and its proximity to sensitive receptors or natural features.

The potential impacts associated with each alternative are discussed in greater detail in the following paragraphs and a ranking for the criterion "Environmental Acceptability" is provided.

- *Increased Waste Diversion* promotes environmental protection and conservation. There is some potential for impacts at diversion facilities (recycling or composting plant) including noise, dust, odour and truck traffic. The effects can typically be mitigated and the extent of impact depends on facility location. Typically, the potential environmental effects associated with a diversion facility are considered less significant than the potential effects associated with a landfill or incineration/high heat process facility. This alternative is ranked as preferred (first) for the criterion "Environmental Acceptability".

- *Incineration/high heat process* facilities that are highly engineered with scrubbers and bag filters and other air pollution control devices to reduce potential impacts on air quality. There is some potential for residual effects resulting from incinerators/high heat processes including noise, air quality impacts, odour and truck traffic. Most of the effects can typically be mitigated and the extent of impact depends on facility location. The remaining solid residues must still be landfilled; a small portion of which must go to a hazardous waste facility. An environmental benefit of incineration/high heat processes is that electricity and/or heat can be generated from processing the waste. Although more electricity can be generated compared to a landfill, incineration/high heat processes is ranked second, equal with landfill for this criterion.

- A highly engineered *landfill* with a liner and system to collect leachate minimizes impacts on ground and surface water, and the regular use of cover material and the collection of landfill gas reduces odours. There is some potential for residual effects resulting from a landfill including water quality effects, noise, dust, odour and truck traffic. Most of the effects can typically be mitigated and the extent of impact depends on facility location. An environmental benefit of landfill is that landfill gas can be used to generate electricity. However the amount of electricity generated is smaller compared to incineration/high heat processes. For this criterion, landfill is ranked second.

- The *export* alternative has similar potential effects as landfill or incineration/high heat processes. The added environmental effects include air emissions from haul trucks, disruption of local residents and users of haul roads. Other potential impacts may include noise, dust, and odours associated with the transfer station(s). Most of the effects can typically be mitigated and the extent of impact depends on facility location. Export is ranked fourth compared to the other alternatives for this criterion because it not only includes the disposal facility effects, but also the waste haul effects.

- The *do-nothing* alternative does not handle the projected waste stream, thus it is not considered environmentally acceptable and is ranked as least preferred (fifth).

3.2.3 Ability of City to Implement the Alternative

This criterion compares the alternatives based on the City's ability and mandate to implement them.

Providing waste management and disposal services is mandated to municipalities under the *Municipal Act*, thus the alternatives *increased diversion*, *landfill*, *incineration/high heat processes* and *export* are all within the City of Sault Ste Marie mandate to provide to residents. In addition, the City is required to provide waste diversion by regulation under the *Environmental Protection Act.*

This criterion also addresses the City's ability to implement the alternatives. The City has significant experience with both *increased diversion* and *landfill* and both are ranked as preferred (first). The City has no experience in the area of *incineration/high heat processes*. It is recognized that this experience can be obtained, however there will be a learning curve for the organization. Generally, given that many *incineration/high heat processes* are proprietary, such facilities would generally be implemented by the private sector under a design/build/operate

scenario often with the facility also being owned by the private sector and the municipality paying a tipping fee under contract. Pilot or demonstration scale facilities such as the Plasco facility in Ottawa and Elementa facility in Sault Ste. Marie offer an opportunity for both the private sector and municipalities to determine the success of the approach prior to investing significant resources in *high heat processes*. Incineration/high heat processes is ranked as third for this criterion.

Regarding *export*, the City also has minimal experience and will have limited control over pricing or the security of contracts in the longer term. It is also noted that the Province has agreed to cease residential waste export to Michigan by December 31, 2010, removing this as an alternative that the City could implement over the long term. There are limited other disposal facilities within a reasonable travel distance. Therefore the City's ability to implement this alternative is considered limited and thus it is ranked as fourth.

The *do-nothing* alternative does not fulfil the legal mandate of the City and is ranked fifth for this criterion.

3.2.4 Flexibility of the System

This criterion compares the alternatives based on how well they could respond to changes in the waste stream that could come about as a result of such things as increased diversion, changes in the economy or fluctuations in waste quantities and types.

- *Increased diversion* increases flexibility in the overall waste management system and can potentially extend the life or reduce the size of any disposal facility it is combined with (i.e. landfill, incineration/high heat process). It is anticipated that government policy regarding waste management will continue to favour waste reduction, thus a strong diversion system is expected to respond well to government 3Rs policies and regulations. This has recently been demonstrated in the MOE's discussion paper released for public consultation in October 2008 entitled "Towards a Zero Waste Future, A Review of the Waste Diversion Act, 2002". It is also noted that public expectation regarding diversion continues to increase. As the diversion markets are continually growing and shifting, this alternative is well suited to adapt to changes in the types and quantity of waste being produced. It is noted however that some system changes would be needed. Diversion is ranked as second for the criterion "Flexibility of the System".

- *Incinerators/high heat processes* require a stable waste quality and quantity as a feedstock to maximize return on the investment in the process. Incinerators/high heat processes should be sized to address both current and future quantities of waste that could reliably be available. For example they can be sized based on assumptions that 60% or higher diversion rates can be achieved. Incinerators/high heat processes can also be developed using a modular approach to accommodate the potential for less or more waste. Incinerator facilities are less flexible to changes in the waste stream or changes in governmental policies and regulations in that more time and/or investment is required to adapt to changes. Once in place, technological changes to the plant are costly. For this reason, facilities are typically designed to manage only the most reliable and dependable waste streams (ie: residential waste). For Sault Ste. Marie this means that an estimated 20,000 to 24,000 tonnes of waste is reliably available for incineration/high heat processes. Thus, this alternative may not be flexible

enough to accommodate the non-uniform waste from the IC&I sector which is important to the economic well being of the City. Incineration/high heat processes are considered to be less flexible than landfill and increased diversion and are ranked third.

- *Landfill* is a flexible disposal method that can respond to increases, decreases or changes in the waste stream. Waste stream changes will simply result in a shorter or longer landfill life span. Based on the assumption noted above that government policy regarding waste management is expected to continue to favour a reduction in waste to be disposed of, a landfill is adaptable to the resulting decrease in disposal need. Landfill is ranked as first or preferred for the criterion "Flexibility of the System".

- *Export* of waste is reliant on the availability of financially feasible destinations and unrestricted export regulations/legislation and trade agreements and thus can be unpredictable. Waste export contracts can also have limited flexibility for changing waste disposal quantities. Export is ranked third for this criterion when compared to the other alternatives.

- There is no flexibility possible with the *do-nothing* alternative, thus it is ranked as least preferred (fifth).

3.2.5 Capability of Managing Waste Quantities and Qualities

This criterion compares alternatives based on whether they could handle the identified waste stream (municipal solid waste).

- The *increased diversion* alternative alone cannot meet all of the waste management needs of the City. In 2009 the City of Sault Ste Marie diverted 34% of its waste from landfill. Even more aggressive diversion is not capable of handling the entire waste stream. Diversion is not a viable stand alone alternative and thus is ranked as fourth for this criterion. A disposal alternative is required in conjunction with increased diversion in order to meet all the waste management needs of the City.

- *Incinerators/high heat processes* are not capable of handling the entire post diversion waste stream. A portion of the post-diversion waste stream (estimated to be 25% to 35%) may not be suitable for incineration or high heat processes and would continue to be landfilled. Furthermore, IC&I waste is not typically included in the design of incineration/high heat facilities as it is not considered to represent a reliable feedstock (ie: the IC&I sector typically minimizes their disposal costs and may elect to dispose of their waste elsewhere). In addition the solid residue (approximately 30% by weight and 10% by volume of the processed waste) produced as a by-product of incineration/high heat processes must also be disposed in a landfill. Incineration/high heat processes can however manage more of the waste stream than diversion and thus is ranked as second.

- A *landfill* can handle the entire identified post diversion waste stream and is considered preferred (ranked first) for the criterion "Capability of Managing Waste Quantities and Qualities".

- *Exporting* waste can handle the identified post diversion waste stream and thus is preferred over diversion and incineration/high heat processes. However, it may not always be reliable as the City is dependent on the availability of economic disposal capacity and as noted above is not in control of decisions made by the receiving disposal facility regarding willingness to accept waste over the long term. The City is also not in control of potential political decisions related to the transport of waste across the border. Thus, this alternative is ranked as second.

- The *do-nothing* option is incapable of handling the identified waste quantities and thus is ranked as least preferred (fifth).

3.2.6 Proven Technical Capability

This criterion compares alternatives based on whether they have been proven through approval of similar facilities as well as consideration of years of successful operating experience in Ontario and other jurisdictions.

The alternatives *increased diversion*, *landfill* and *export* are proven technologies with significant experience both within Sault Ste. Marie and other Ontario jurisdictions. As noted under the previous criteria, diversion is capable of managing specific waste streams e.g., household organics, but not the entire waste stream.

Traditional *incineration* (conventional combustion) also has a proven technical capability and there has been Ontario based experience with this alternative. *High heat processes* however, are still in the pilot and demonstration stages in Canada and are not currently in full scale operation anywhere in Ontario. It is anticipated (based on proposed facilities and pilots) that within a few years there may be more experience in North America with high heat processes. Thus, it is noted that the evaluation for this criterion generally assumes incineration rather than high heat processes.

Thus, all these alternatives are considered to generally be proven and ranked first in the evaluation.

The *do-nothing* option has no proven technical capability to manage the waste and is ranked fifth.

3.2.7 Economic/Cost

This criterion compares the lifecycle cost of the alternatives. The costs of the alternatives under consideration range from $45 to at least $190 per tonne. All costs are presented as ranges to reflect the fact that the cost depends on a number of variables.

The cost for *increased diversion*, at $45 to $170 per tonne, is based on the expected costs to include additional organics in the existing diversion system or to expand material types collected or increase the quantity of materials collected in the residential blue/yellow box program. These costs are based on operating experience with these types of facilities. This alternative is ranked first for this criteria.

Based on procurement processes for design, build and operate facilities, it is estimated that the cost for *incineration/high heat processes* will be in the range of $110 to $190 per tonne for a

suitably sized facility for Sault Ste. Marie. This estimate is net of any revenues from the sale of electricity. This alternative is the most expensive and is ranked fourth.

It should be noted that the City has entered into a waste supply agreement with Elementa to send a minimum of 12,500 tonnes per year of municipal solid waste at a cost of $60 per tonne in the first year of full processing and indexed to inflation in future years. This tipping fee may be lower than industry average since grants and incentives are typically offered to assist new technology providers and/or there may be a strong desire to prove the capabilities of the technology to enhance future marketability.

Current fees at the Sault Ste. Marie *Landfill* comprise of a gate fee or tipping fee for residential customers and a $65/tonne tipping fee for IC&I customers. A 2003 survey identified that the average municipal tipping fee amongst the surveyed municipalities was about $69 per tonne. For the purposes of comparison, a present value analysis was also completed in 2003 to identify a suitable tipping fee to develop and operate a new 2.0 million tonne disposal facility (ie: approximate site life of 25 to 30 years). The analysis identified a tipping fee in the range of $65 per tonne should be adequate to cover the lifecycle costs of a new facility. A cost range of $70 to $80/tonne has been adopted which could reflect expansion of an existing site or a new site. The cost of landfill assumes a revenue neutral position relating to the sale of electricity. Landfill is ranked first for the "Economic/Cost" criterion.

Export to another facility, includes the tipping fee cost[6] as well as transfer station costs and haul costs. A range of $85 to $105 per tonne has been developed for export. This cost range was developed using the same approach used for landfill. The transfer station costs and haul costs were added to the tipping fees developed for the landfill option. This alternative is particularly sensitive to the tipping fees charged and the overall haul distance. Export is ranked third for the "Economic/Cost" criterion.

The *do-nothing* alternative, involves no immediate costs however considering lifecycle costs and the likely higher, long term cost for emergency disposal when there is no remaining disposal capacity, this alternative is considered least preferred (fifth).

Increased diversion and *landfill* are both considered to have a lower cost range and are ranked as first.

3.3 "Alternatives To" Evaluation Results

Table 5 summarizes the rankings for each of the criteria. A rank of first is preferred and a rank of fifth is least preferred. The cells of the table have also been highlighted from darkest (preferred) to lightest (least preferred) to visually represent the ranking.

[6] For the purpose of establishing a cost for export, it was assumed the material would be exported to a landfill facility.

Table 5
SUMMARY OF "ALTERNATIVES TO" RANKING

Criterion	Increased Waste Diversion	Landfill	Incineration / High Heat Processes	Export	Do Nothing
Compliance with Regulations and Policies	Ranked First	Ranked First	Ranked First	Ranked Fourth	Ranked Fifth
Environmental Acceptability	Ranked First	Ranked Second	Ranked Second	Ranked Fourth	Ranked Fifth
Ability of City to Implement the Alternative	Ranked First	Ranked First	Ranked Third	Ranked Fourth	Ranked Fifth
Flexibility of the System	Ranked Second	Ranked First	Ranked Third	Ranked Third	Ranked Fifth
Capability of Managing Waste Quantities and Qualities	Ranked Fourth	Ranked First	Ranked Second	Ranked Second	Ranked Fifth
Proven Technical Capability	Ranked First	Ranked First	Ranked First	Ranked First	Ranked Fifth
Economic/Cost	Ranked First	Ranked First	Ranked Fourth	Ranked Third	Ranked Fifth

Table 5 clearly shows that the *do-nothing* alternative has no advantages for any of the criteria considered. The table also shows that *export* has few advantages when compared to the other alternatives. This is consistent with the input received at the public input sessions where comments were received that the do-nothing alternative was not a realistic option and exporting waste is not reliable or sustainable for the long term.

Table 5 also clearly demonstrates that *increased waste diversion* is considered to be a preferred method of managing Sault Ste. Marie's waste. It is ranked as preferred or equal to other alternatives for five of the seven criteria. This alternative was also strongly supported by the public during consultation events. The primary disadvantage of this alternative is that it can only manage a portion of the City's waste.

The remaining two alternatives, *landfill* and *incineration/high heat processes*, are considered to be equal for three of the following criteria:

- Compliance with Regulations and Policies – both landfill and incineration/high heat processes can comply with regulations and policies.
- Environmental Acceptability – both alternatives are highly engineered and can be designed to minimize potential for environmental effects.
- Proven Technical Capability – both alternatives have a proven ability to manage solid waste.

Landfill is preferred when compared to *incineration/high heat processes* for the remaining four criteria:

- Ability of the City to Implement the Alternative – the City has significant experience with landfill and no experience with incineration/high heat processes. The City would likely have to rely on the private sector to operate an incinerator or high heat technology but could continue to operate a landfill site.

- Flexibility of the System – landfill is considered to be more flexible in its ability to be quickly and efficiently adapted to changes in the waste stream, fluctuation in quantity and changes in government regulations and policies; whereas incineration/high heat process facilities must be designed for a specified waste stream and can be costly to retrofit and/or expand.
- Capability of Managing Waste Quantities and Qualities – landfill can accommodate all of Sault Ste. Marie's waste[7]; whereas incineration/high heat process must be designed for the most reliable component of the waste stream and this reduces its ability to include some of the other waste (e.g. IC&I) which is an important factor in attracting and retaining economic development in Sault Ste. Marie.
- Economic/Cost – Landfill is currently significantly less costly than incineration/high heat processes with a cost range of $70-$80 per tonne compared to $110 to $190 per tonne for incineration/high heat processes depending on the technology used.

It is noted that based on the discussion about evaluation criteria at the Public Input Session in June 2007, issues related to environmental acceptability, and cost were top of mind for session participants. Landfill is equal or preferred over incineration/high heat processes for both of these criteria.

Overall, **the preferred way for Sault Ste. Marie to manage its residual solid waste at this time is a combination of increased diversion and landfill**. This combination of alternatives is the most flexible to address changes in waste streams and increases in recycling and reduction of waste. These alternatives together can fulfill all of Sault Ste. Marie's waste management needs including continuing to service the IC&I sector in a cost effective manner and should not result in a significant cost increase to implement and operate.

During consultation on the "Alternatives To", comments were received in support of increased diversion and landfill. Comments were also received in support of incineration/high heat processes. It is noted that the recent agreement endorsed between the City of Sault Ste. Marie and Elementa effectively incorporates high heat processes in the City's overall waste management plan. Elementa is currently proceeding with their own Environmental Screening process and is also pursuing necessary technical approvals required to facilitate the construction and operation of their proposed plant. They hope to be operational in the spring of 2011.

[7] It is noted that for both Landfill and Incineration/High Heat Processes, household hazardous waste must be collected and disposed of separately.

4.0 PUBLIC CONSULTATION PROGRAM

A comprehensive public consultation program was devised to solicit input from governmental agencies, stakeholders, First Nations and the general public regarding the "Alternatives To", the evaluation criteria, and the relative importance of the criteria.

To date, consultation on the Environmental Assessment (prior consultation also occurred on the EA Terms of Reference and Waste Management Planning work) has included:

- **Notice of Commencement of the EA** was placed in the local paper, posted on the City web site and mailed to those on the project mailing list;

- **Newsletter No. 1** (October 2006) providing information on the EA process and contact names was mailed to approximately 393 contacts on the project mailing list; and

- A **Public Input Session** was held on June 26, 2007 to obtain input on the alternatives being considered and the evaluation criteria as presented in the "Alternatives To" Working Draft made available on the City web site. The Session was advertised in the local newspapers as well as the City web site and notice was distributed to those on the project mailing list. Copies of the notice were also forwarded to adjacent communities or community groups (ie: Batchewana First Nation, Garden River First Nation, Prince Township, Metis Nation of Ontario, and Missanabie Cree) for posting on their websites and in prominent locations within their communities. Prior to the session, two working papers ("Waste Quantity Projections and Existing Environment Profile" and "Alternatives to the Undertaking") were made available for review at public libraries, municipal offices, First Nations offices and the City web site. Ten (10) participants recorded their names on the sign-in sheet for this event. A copy of the full report on the June 26, 2007 Public Input Session is included as an Appendix to this report.

- **Newsletter No. 2** (May 2010) providing information on the EA process, the City's contractual relationship with Elementa, results of the "Alternatives To" evaluation, the level of diversion being achieved, next steps in the process and contact names was mailed to approximately 383 contacts on the project mailing list; and

- A **Public Information Centre** was held on June 3, 2010 in the Thompson Room at the Civic Centre. The session provided a forum for interested individuals, agency representatives, and stakeholders, to obtain updated information regarding waste management planning, gain an understanding of the Environmental Assessment process, review and provide comments on the results of the "alternatives to" evaluation, identify the next steps in the process and have questions answered. The Session was advertised in the local newspapers, Shaw Cable 10 and the City web site and a notice was distributed to those on the project mailing list. Copies of the notice were also forwarded to adjacent communities or community groups (ie: Batchewana First Nation, Garden River First Nation, Prince Township, Metis Nation of Ontario, and Missanabie Cree). Ten (10) participants recorded their names on the sign-in sheet and the total participation is estimated to be in the range of 20 people. A copy of the full report on the June 3, 2010 Public Information Centre is included as an Appendix to this report.

Table 6 highlights some of the key comments from the June 26, 2007 Input Session related to the "alternatives to" and ***Table 7*** summarizes some of the key comments/questions from the June 3, 2010 Information Centre.

Table 6 **COMMENTS RECEIVED REGARDING THE "ALTERNATIVES TO" – JUNE 2007**
Increased Diversion
Materials are increasing in value so we may be able to get more revenue for recycled materials.
New generations are teaching their parents and we may see more emphasis on recycling in the future.
Landfill
Landfill is flexible and proven.
Should be considered an interim "storage" solution.
Landfills may be regarded as a resource when landfill mining becomes economical.
Incineration/High Heat Processes
SSM could consider a larger service area to allow incineration/high heat processes to be more cost effective.
May be a long term management approach but current economic conditions make incineration/high heat too costly.
SSM should not overlook incineration/high heat as a future waste management option. A lot can change over the years and it may prove to be beneficial and cost effective in the future.
Cleaner with less emissions than landfill.
Should look to the private sector as they have more experience with the technology.
Export
Not reliable or sustainable for the long term.
Should deal with waste at the source and time of generation.
Do-Nothing
Not considered to be a realistic option as there is a need to manage waste.
Other Comments
Manufacturing and packaging are changing so we need a system that has the flexibility to manage this change and adapt to less waste.

Table 7
COMMENTS/QUESTIONS FROM THE JUNE 2010 INFORMATION CENTRE

Comment/Question	Response
Has consideration been given to the energy requirements to recycle plastics vs. thermally processing plastics?	Municipalities are mandated by Provincial legislation to collect and recycle No's 1 and 2 plastics (ie. designated by the province). In Sault Ste. Marie, other plastics (ie: numbers 3 through 7) are currently being disposed of in landfill and are currently available for thermal processing. A comparison of the energy requirements to recycle no's 1 and 2 plastics relative to thermally processing these materials is beyond the scope of this study and should be done at the Provincial level at the time materials are designated.
A concern was noted regarding the potential impact of the landfill on groundwater resources in the area of the landfill site. It was noted that the City had extended the Municipal water distribution system along Fifth Line to the west of the landfill to address water quality concerns in drinking water wells in this area.	The extension of the Municipal water distribution system to the landfill site was completed in 1997± to address potential concerns with potable water quality on the landfill site itself. The City is not aware of any water quality problems in potable wells surrounding the landfill site that may be attributable to the landfilling operations. (Note: time was also spent educating the individual regarding the various monitoring and leachate control systems that are present at the existing landfill site to safeguard groundwater quality beyond the boundaries of the landfill site)
The biosolids generated at the two waste water pollution control plants could be processed in the proposed Elementa facility.	This may be a viable approach but Elementa has not yet tested and confirmed that biosolids can be processed effectively in their facility. Furthermore their proposed commercial scale plant will not have adequate capacity to process all residual waste generated in Sault Ste. Marie and they will likely prefer waste streams with higher energy content if available.
Surprised that thermal processes did not fare better in the evaluation relative to landfilling.	The rationale for the rankings is included in a summary table in the "Alternatives to the Undertaking" report - any comments on individual rankings are encouraged.

Aboriginal Consultation

Consultation with Aboriginal peoples is an important component of an EA consultation program. For the Sault Ste. Marie Solid Waste Management Environmental Assessment, project notification (notice of commencement, newsletters, notice of public input session and public information centre) was sent to Batchewana First Nation, Garden River First Nation, Metis Nation of Ontario, and Missanabie Cree.

A **meeting** with Batchewana First Nation was held on July 31, 2007 at the Batchewana First Nation Office to discuss the project progress and consultation strategies. A letter was sent to the Chief in January 2007 to let them know that the project team will be contacting them to arrange this meeting. Two members of the First Nations community (including the Chief) attended the meeting with a representative from AECOM and the City of Sault Ste. Marie. The Chief offered the following comments:

- Their Community has an inherent responsibility to look after the environment and in particular the lands and waterways that are included in their traditional territory as defined in the 1850 Robinson Huron Treaty.
- Any development within their traditional territory would require the endorsement of Batchewana First Nation. A map illustrating the land mass that is the subject of the treaty was reviewed. The treaty lands cover a significant area from the St. Mary's River northerly well beyond the current study area.
- Chief Sayers also expressed an interest in partnering with the City and cited an example of a possible partnership with Brookfield Power north of the City. He also noted that they have discussed waste management issues with Oneida of the Thames Reserve which is near the Greenlane landfill.
- Chief Sayers explained that a briefing note will be prepared and put on the Band Council agenda (public forum). Subject to Band Council approval, Batchewana FN will proceed with a community brainstorming session. Through this session Batchewana FN will identify a preferred alternative from their perspective together with the rationale for the selection. This information will be forwarded to the City. Chief Sayers noted that with the material provided, City representation is not required at the meeting.

A **Public Open House** was conducted on August 9, 2007 in Garden River First Nation (GRFN) Community Centre. The Open House was advertised in the local newspaper, the City and Garden River First Nation websites, in the Garden River First Nation newsletter and notices were forwarded to the Garden River First Nation for posting in prominent locations within their community. The event was also advertised for two days in advance of the event on the changeable message sign located along Highway 17 in front of Community Hall. The session was conducted in an open house format which allowed interested individuals to attend at any time between 4:00 pm and 7:00 pm. Representatives of AECOM, and the City of Sault Ste. Marie were in attendance throughout the session to provide information, address questions, and facilitate discussions. A total of 5 individuals recorded their names on the sign-in sheet. In general, there was considerable interest in expanded diversion programs and an understanding that there will always be some form of waste disposal required in the future. A copy of the full report on the August 9, 2007 Open House is included as an Appendix to this report.

On June 8, 2010 the project consultants and City staff attended a Garden River First Nation Band Council meeting. The objectives of the visit included:

- Provide an update on waste management planning in the City;
- Provide an overview of the Environmental Assessment process ;
- Review the solid waste management alternatives considered during the Environmental Assessment process;
- Present the preferred waste management alternative;
- Provide the next steps in the Environmental Assessment process; and

- Answer questions.

At the onset of the meeting Band Council articulated that the purpose of the meeting was to share information and should not be considered consultation. The principle concern raised by Band Council was the potential for the existing landfill to adversely impact Root River water quality which is located adjacent to the City's landfill and ultimately discharges to the St. Mary's River which flows through GRFN. The existing leachate monitoring and control systems that are in place to mitigate off-site impacts were described in detail. A copy of the meeting report is included in an Appendix to this report.

5.0 NEXT STEPS

This evaluation of "alternatives to" will form part of the environmental assessment document for the Sault Ste. Marie solid waste management environmental assessment.

With landfill and increased diversion as the preferred "alternative to", the next step in the process will be to identify alternative methods of landfilling waste. This exercise will include consideration of options to expand the existing landfill and new landfill options.

The City will also continue to investigate initiatives and programs to increase waste diversion following the 3R's: reduce, reuse and recycle. Enhancement of diversion initiatives and programs does not require EA approval and will not be included in future EA reports. Updates on future waste diversion initiatives and programs will be advertised and promoted by the City through various means such as the City's website, the EA Study newsletter, and local newspapers.

Table 4
EVALUATION MATRIX
"Alternatives To" Description and Ranking by Criterion

Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
Compliance with regulations and policies	**Ranked First**: Diversion facilities and activities can be designed to meet applicable government policies and regulations and there are many currently operating facilities that meet requirements. The province's target is to achieve 60% diversion.	**Ranked First**: Landfill can be designed and operated to meet all applicable government policies and regulations. Many facilities currently meeting requirements.	**Ranked First**: Incineration/high heat processes and RDF production have the ability to meet all applicable regulations and policies. The technologies available to mitigate air pollution have advanced such that incineration facilities in Ontario and Europe operate well within the regulatory limits for various air pollutants. Limited number of facilities currently meeting requirements in Ontario.	**Ranked Fourth**: Disposal sites which receive exported waste must be in compliance with all applicable government regulations and policies in their jurisdiction. Many facilities currently meeting requirements. However, it is noted that the province has agreed to cease residential waste export to Michigan by December 31, 2010. There are draft provincial guidelines in place supporting the management of waste close to source.	**Ranked Fifth**: The do-nothing option would lead to closure of the City landfill and would not meet the municipal mandate to provide disposal capacity.

[8] Generally, the evaluation assumes incineration as there is limited experience with high heat processes in Ontario.

Table 4
EVALUATION MATRIX
"Alternatives To" Description and Ranking by Criterion

Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
Environmental acceptability	**Ranked First**: Diversion promotes environmental protection and conservation.	**Ranked Second**: Modern landfills are highly engineered and landfilling can be undertaken in an environmentally sound manner.	**Ranked Second**: Modern incineration/high heat/RDF processes are highly engineered and can be undertaken in an environmentally sound manner.	**Ranked Fourth**: Site(s) will be licensed for operation and must meet environmental protection requirements.	**Ranked Fifth**: Does not handle the projected waste stream, so not environmentally acceptable.
	Potential for environmental effects: • Some potential for nuisance impacts (noise, odour, dust, truck traffic)	Potential for environmental effects: • Some potential for nuisance impacts (noise, odour, dust, truck traffic)	Potential for environmental effects: • Some potential for nuisance impacts (noise, odour, truck traffic)	Potential for environmental effects: • Some potential for nuisance impacts (noise, odour, dust, truck traffic)	Potential for environmental effects:
	• Limited air quality lifecycle emissions	• Potential air quality lifecycle emissions: - higher net GHG and smog precursors and acid gases than Incineration - lower net heavy metals and dioxin	• Potential air quality lifecycle emissions: - lower net emissions of GHG and smog precursors and acid gases than landfill - higher net emissions of heavy metals and dioxins	• Potential for air quality lifecycle emissions depends on nature of disposal facility • Additional emissions related to extra truck traffic	• Limited air quality lifecycle emissions
	• Lowest potential for impacts to water.	• Landfill has potential for greater impact on ground and surface water. However engineered facilities include a liner and leachate management system that mitigates the potential for negative effects.	• Incineration/high heat processes still requires landfilling of a small quantity of residual materials. For conventional incineration, the bottom ash is generally stable, but the fly ash (5% by weight) must be stabilized before landfilling so that heavy metals cannot leach. In	• Potential for impact on ground and surface water depends on the nature of disposal facility	• Limited impact to water

Table 4
EVALUATION MATRIX
"Alternatives To" Description and Ranking by Criterion

Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
			addition, engineered landfills include a liner and leachate management system that mitigates the potential for negative effects.		
	Effects can typically be mitigated; significance of effect depends on location of facility. Typically, the potential environmental effects associated with a diversion facility are considered less significant than the potential effects associated with a landfill or incineration/high heat process facility.	Most of the effects can typically be mitigated and the extent of impact depends on facility location.	Most of the effects can typically be mitigated and the extent of impact depends on facility location.	Added environmental effects resulting from transfer station operations, haulage including air emissions from haul trucks, disruption of local residents and users of haul roads.	Significant adverse impacts from illegal dumping.
	Environmental benefits: • recovery of non-renewable resources.	Environmental benefits: • Some recovery on-site of non-renewable resources • Landfill gas can be collected and can recover electrical energy.	Environmental benefits: • Pre or post processing can recover some non-renewable resources • An incinerator/high heat process facility can recover more energy than landfill.	Environmental benefits: dependant on disposal facility.	Environmental benefits: none
Ability of City to implement the alternative	**Ranked First**: City is required to provide waste diversion by regulation	**Ranked First**: City is required to provide waste disposal, and has many	**Ranked Third**: City is required to provide waste disposal, and can consider incineration/high	**Ranked Fourth**: City is required to provide waste disposal and can export	**Ranked Fifth**: City is required to provide waste

Table 4
EVALUATION MATRIX
"Alternatives To" Description and Ranking by Criterion

Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
	under the *Environmental Protection Act* and has been doing so for many years.	years of experience with landfilling.	heat or RDF processes. Need to consider procurement approaches. The municipality could design/build/own/operate a facility or enter into a "put or pay" (pay for minimum guaranteed tonnages) contract with a private company that would develop a facility (ie: similar to the existing blue/yellow box recycling contract). This alternative involves a considerable learning curve for municipal staff.	waste but will have less control on pricing and security of contracts in the long term for the waste exported. The province has agreed to cease residential waste export to Michigan by December 31, 2010. The City's ability to implement this alternative is significantly restricted by the limited number of waste disposal facilities in the area that have adequate capacity and can accept waste from Sault Ste. Marie.	disposal, therefore do-nothing is not acceptable.
Flexibility of the system	**Ranked Second**: Increased diversion increases flexibility in the overall waste management system and responds to government 3Rs policies, regulations and public expectations. To date waste diversion systems have been able to respond to new materials	**Ranked First**: Landfill has a high degree of flexibility in respond to changes in the waste stream, fluctuations in waste quantities and changes in government regulations and policies. Increased quantities will reduce site life and reduced quantities will increase site life.	**Ranked Third**: Generally, incineration/high heat processes are somewhat 'less flexible' to changes in waste quantities than landfill as changes to the facility are typically costly. Thus, facilities are typically designed for only the most reliable/dependable waste stream (ie: the residential stream). This reduces the flexibility to manage IC&I	**Ranked Third**: The export of waste is reliant on the availability of financially feasible destinations and unrestricted export regulations/legislation and trade agreements and thus can be unpredictable. Waste export contracts can also have limited	**Ranked Fifth**: There is no flexibility possible with the do-nothing alternative.

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Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
	and increased quantities through expansion and innovation. Changes to materials collected may require system modifications or upgrades.		waste component. The total quantity of waste assumed for incineration, gasification/pyrolysis or RDF production in Sault Ste. Marie is in the order of 20,000 to 24,000 tonnes per year. This is a relatively low quantity of feedstock. There are however, facilities operating at this scale in other jurisdictions (e.g. Norway, Denmark).	flexibility for changing waste disposal quantities.	
Capability of managing waste quantities and qualities	**Ranked Fourth**: The City diverted approximately 11,740 tonnes of residential waste in 2009 (34% diversion rate). Even aggressive diversion is not capable of handling the entire waste stream.	**Ranked First**: A MSW landfill can handle the entire identified waste stream. Hazardous wastes must be managed at special disposal facilities.	**Ranked Second**: Of the total waste stream, it is estimated that 49,000 to 56,000TPY (ie: 65% to 75%) of waste generated by residential and IC&I sources is suitable for processing in an incinerator or high heat process. Materials that are generally unsuitable include municipal waste (often street sweepings, catch basin clean-out materials), sewage sludge, and contaminated soil. However, it is also noted that these facilities are typically designed to only handle the residential waste stream which	**Ranked Second**: Exporting waste to a landfill can handle the identified waste stream; however, the City is dependent on the availability of economic disposal capacity. Hazardous wastes must be managed at special disposal facilities. The City also does not have control over political decisions related to the border.	**Ranked Fifth**: The do-nothing option is incapable of handling the identified waste quantities.

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Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
			is the most reliable waste stream resulting in only 20,000 to 24,000 tonnes of waste being directed to incineration/high heat processes. The solid residual wastes that are produced as by-products of the processes must also be landfilled and represent approximately 25% - 30% by weight and 10% by volume of the processed waste. Hazardous wastes must be managed at special disposal facilities.		
Proven technical capability	**Ranked First**: Current proven diversion technology is capable of managing specific waste streams e.g. blue box materials and household organics, but not the entire waste stream.	**Ranked First**: Landfill has a proven technical capability to manage the projected waste quantities. Engineering designs have advanced significantly to reduce environmental impacts.	**Ranked First**: Operating experience with incineration in North America and Europe has established a reasonable operating track record and a much-improved track record with regards to environmental protection. There are over 400 incinerators worldwide operating with full environmental compliance and very low emissions. Generally, incineration is assumed for this criterion.	**Ranked First**: Disposal facilities with proven technical capability may be available to the City.	**Ranked Fifth**: The do-nothing option has no proven technical capability to manage the waste.

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Criteria	Increased Waste Diversion	Landfill	Incineration/High Heat Processes[8]	Export	Do-Nothing
			Less operating experience with gasification/pyrolysis within few facilities in Europe or North America. Current operating examples can be found primarily in Japan and Germany. Over the past few years since the passage of the European Union (EU) landfill directive, a number of RDF facilities have been developed in Europe. Many of these facilities market the RDF to existing cement kilns and industrial uses. Mechanical/Biological Treatment (MBT) component is considered reasonably reliable given past experience with mechanical component and aerobic composting.		
Economic/Cost	**Ranked First**: Approximately $45 to $170/tonne	**Ranked First**: Approximately $70-$80/tonne and assumes a revenue neutral position relating to the sale of electricity.	**Ranked Fourth**: There is a significant range in potential costs related to Incineration, Gasification or RDF generation options. **Incineration:** cost range in the order of $110 to $190 per tonne **Gasification/Pyrolysis:** cost	**Ranked Third**: Approximately $85-$105/tonne	**Ranked Fifth**: No immediate cost but high potential long term cost as problem is not addressed.

Table 4 EVALUATION MATRIX "Alternatives To" Description and Ranking by Criterion					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes**[8]	**Export**	**Do-Nothing**
			range in the order of $110 to $190 per tonne, or possibly higher (costs uncertain due to lack of operating facilities) **Refuse Derived Fuel:** cost range in the order of $65 to $130 or more per tonne. Net system cost assumes conservative market price for electrical energy generated from thermal treatment of waste and for ferrous metals recovered from ash/char.		