City of Sault Ste. Marie

Sault Ste. Marie Solid Waste Management Environmental Assessment

Draft – May 24, 2017

AECOM

DILLON CONSULTING

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1.0 INTRODUCTION

1.1 Purpose of this Environmental Assessment

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, consisting 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 3Rs hierarchy of reduce, reuse and recycle (see Section 1.4).

The City has implemented and/or promoted/supported programs to divert typical "blue box" (i.e. containers and fibres) recyclables for single-family and multi-family homes, small businesses, electronic waste, styrofoam, used tires, leaf and yard waste, clean wood, Christmas trees, metals including white goods and appliances, propane tanks, batteries, household items, construction and renovation materials, and municipal hazardous waste. The City has complemented these programs with waste set out limits and landfill bans 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 and Climate Change (MOECC) in September, 2005. This EA report documents the EA that was undertaken based on the approved ToR.

1.2 The Proposed Undertaking

The undertaking described in this document is an expansion of the Sault Ste. Marie Landfill footprint located at 402 Fifth Line East (refer to **Figure 1.1**). The service area will be the same as the existing landfill, (i.e. the City of Sault Ste. Marie, Prince Township and Batchewana First Nation's Rankin Reserve). The expansion will have a disposal capacity of 4.2 million m^3 (i.e. 2.33 million tonnes) of waste. It is forecasted that waste will be landfilled at a maximum rate of approximately 78,500 tonnes annually. The site is expected to last until 2055.

The landfill will only accept non-hazardous solid residential, industrial, commercial and institutional (IC&I), and construction and demolition (C&D) waste, and biosolids.

The proposed expansion includes new disposal boundaries to the north and west of the existing footprint and a moderate increase in the height of the waste. Landfill mining is also proposed within the western portion of the existing disposal footprint to facilitate the

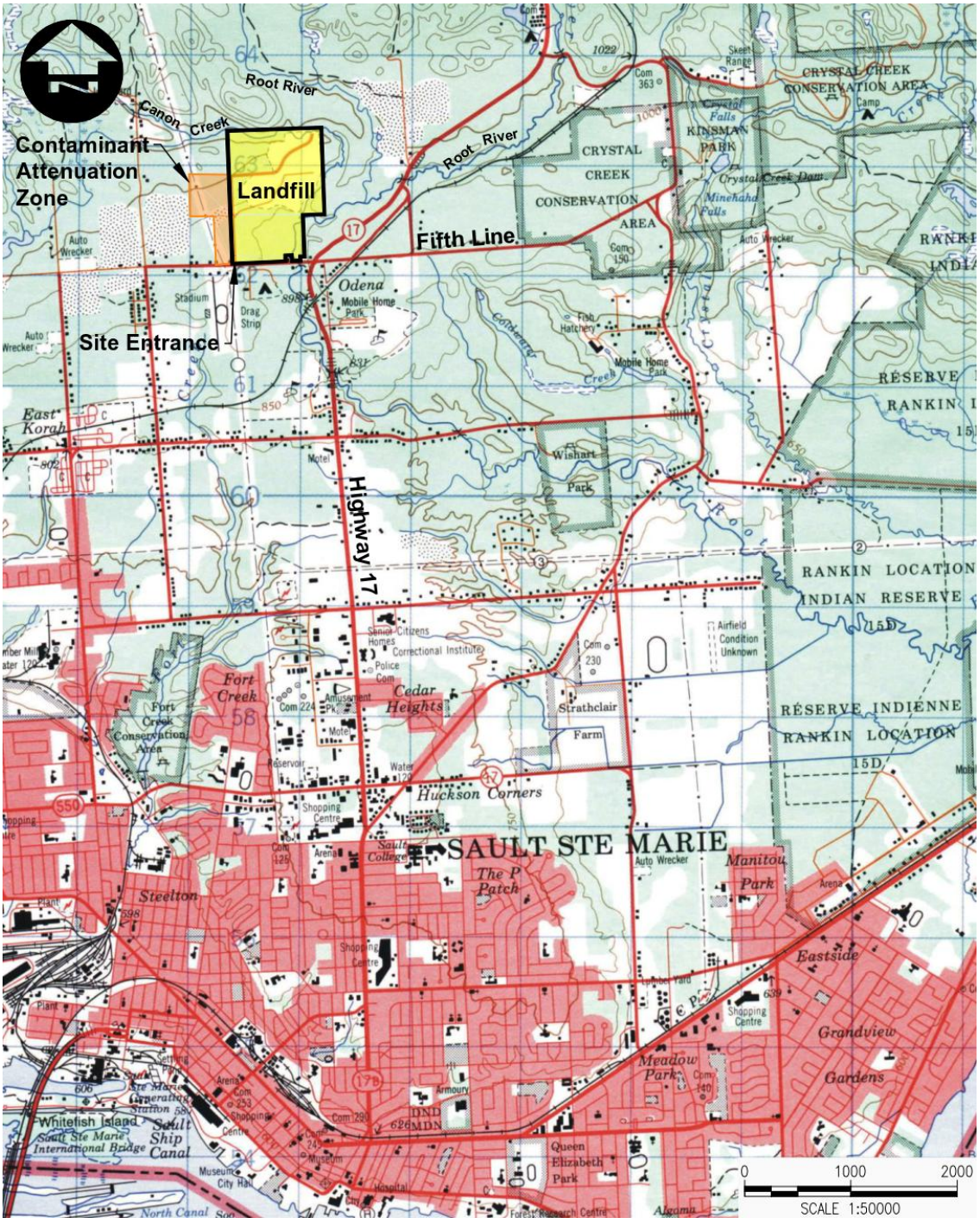


Figure 1.1 – City of Sault Ste. Marie Municipal Landfill Key Plan

construction of a liner to enhance environmental management at the site. The mining process involves excavation of waste within the existing disposal footprint, removing fines and recyclables, transferring the residual waste to a new lined cell and lining the mined area to accommodate future waste disposal. The planned expansion will be accommodated entirely within existing City-owned lands.

The expanded landfill will have a fill area of approximately 44.5 ha within the 145.1 ha site. The maximum elevation of the fill area will be 314 metres above sea level (masl). The expansion will include a liner, a leachate collection system and a stormwater management system.

1.3 Background

In September 2000, the City initiated a Solid Waste Management planning process to provide direction on all aspects of solid waste management. The plan was completed in the following 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.

The reports prepared in these phases provide significant details regarding the background on the existing and future waste management system in the City. Public input was solicited in each phase. The phases are summarized below.

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 its residential diversion rate from approximately 9% in 1999 to 36% in 2014.

In addition, the City received funding through the Green Municipal Enabling Fund (GMEF) to undertake a feasibility study on co-composting residential organics, leaf and yard waste and municipal biosolids. The *Co-composting Pilot Study* report was finalized in February 2004 and updated in 2017 to consider the most recent changes to Ontario's composting regulations.

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

was obtained. This work was revisited and confirmed through the "Alternatives To" evaluation completed as part of this study.

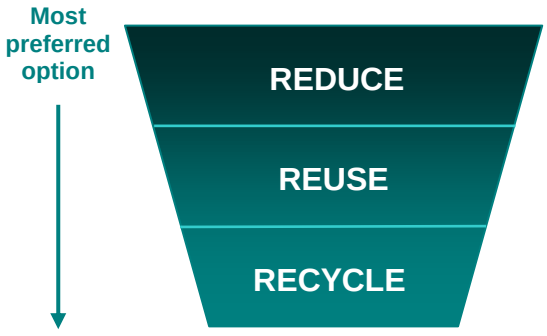
Phase 3 of the study was completed in February 2003 with the release of the *Business and Implementation Plan*. This plan outlines the costs of expanded waste diversion programs and waste disposal and explores options to recover those costs. The result of this report was that Council approved the implementation 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 is being undertaken in 2017.

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 City subsequently initiated this Waste Management EA in 2006.

1.4 Overview of the City's Waste Management System

The population serviced through the City's waste management system is approximately 75,141 residents[1] (Note: the population has remained relatively stable since 2011). 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 at civic address 402 Fifth Line East. The City completed a Waste Quantities Report (June 2010) which documents historical waste quantities and predicts future residual waste disposal quantities. The historical and projected waste quantities presented in that report have been updated in this EA document to consider historical quantities for the period from 2010 through 2014 and population projections developed by City Planning staff in 2015 (refer to Section 2.0). In addition a Site Development and Operations Report is prepared annually for the existing landfill site and the site life is projected to extend to approximately 2021-2022 based on the 2015 report.



The City has been very diligent to promote, develop and enhance waste diversion programs and services that support the 3Rs hierarchy: reduce, reuse and recycle and has complemented these programs and services with by-laws to encourage residents to divert waste. In addition to the system changes the

[1] Stats Canada 2011 Census Data

City also established a position for a Waste Diversion Supervisor in 2001. The role of the Waste Diversion Supervisor is to promote and manage waste diversion programs within the Municipality and where appropriate implement new diversion ideas.

An overview of the City's principle waste diversion programs is provided below.

- The City offers an extensive curbside recycling program which services approximately 26,251 single family households[2]. In addition the program services approximately 6,266 multi-residential units[2]. 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.

- It is estimated that approximately 12,100[2] backyard composters have been distributed to residents in years past. The City also collects leaf and yard waste bi-weekly throughout the growing season (i.e. 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 Division.

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

- The City has also established a permanent Household Hazardous Waste Depot (HHW) at City Landfill site. The facility was moved in 2016 from its former location in the City's Public Works yard on Industrial Park Crescent to the landfill. The move was made to provide a "one stop location" for all waste management needs including recyclables, household hazardous waste and residual waste. The facility has been operational since 2001 and has been effective in diverting HHW generated within Sault Ste. Marie and surrounding areas. The management and operation of the HHW program became a Stewards responsibility in July, 2010. The City continues to own and operate the facility under a contract with the Stewards but this may change in the future.

- 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. The tipping fee and gate fee at the landfill have been increased over time from $27.50/tonne and $2/visit to the current rates of $70/tonne and $10/visit respectively. In 2006 the City also reduced the permissible weight associated with the gate fee from 500 kg to 300 kg. The City continues to recognize the importance of waste setout limits to strongly encourage residential

[2] 2014 WDO Datacall

diversion and is contemplating further reductions in conjunction with its ongoing update to its waste management systems business and implementation plan.

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

In addition to these programs, 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 number of plastic bags generated and encourages them to shop with reusable shopping bags instead. The City also provides a discounted beverage price to patrons that bring their own refillable cups to some of its venues within the City.

The City also takes a proactive role to lead by example through its own corporate waste reduction and recycling activities. Specific corporate initiatives developed and undertaken by the City have included:

- Super Sorters – Twenty seven Super Sorter Three-In-One recycling bins were purchased and distributed throughout City arenas, recreational facilities and major parks/marinas. In support of this initiative, the Public Works Sign Shop assisted in a custom designed sign for the front of the bins to educate patrons regarding proper diversion/disposal of materials. Promotional events were also conducted at the time of the launch to gain public support and encourage their use.

- Waste Reduction Week – The City for the past few years has promoted Waste Reduction Week, which runs in October. The City staff has been encouraged to bring in unwanted electronics to facilitate proper management. A proclamation has been made to help support community awareness of the event.

- 20-Minute Makeover – Each year the City hosts the 20-Minute Makeover where local residents are encouraged to spend 20 minutes, typically on earth day, to clean up their property. Over the past 4 years the City has had more than 500 participants each year. This promotes City beautification and brings awareness to the negative impacts of littering.

- Green Days/Kids Being Green – This campaign is completed by City summer students bringing awareness to the importance of recycling.

- Battery recycling – There is battery recycling station located in City Hall to collect disposable batteries and rechargeable batteries.

- Ink Cartridge Recycling – An ink cartridge recycling station is located in City Hall to collect used ink cartridges from across the corporation. These items are taken back and managed by the original vendors.

The City strongly encourages the business sector to comply with recycling mandates. The City initiated a fluorescent light program that targets local businesses and the public to drop off bulbs at the Household Hazardous Waste Depot so they can be safely managed and transported to a recycling facility.

There are also a number of public and private sector initiatives in our Community that are supported and encouraged by the City as described in the following paragraphs.

In an effort 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. Other private sector initiatives that support reuse include the local Value Village retail store and Canadian Diabetes Association which accepts used clothing and household items.

The City provides financial support to Community Living Algoma which operates a local WEEE and Styrofoam depot. The facility receives, sorts and transports computers, keyboards, monitors, computer peripherals, phones, cell phones and Styrofoam.

The City supports the efforts of Clean North which is a citizen based environmental group that promotes environmental protection through various programs and initiatives focused on reduction, reuse and recycling. Programs include an annual Christmas tree chipping event and freecycle days to promote reuse of unwanted items.

Through the City based programs, approximately 10,399 tonnes of residential material was diverted from disposal in 2014. This represents a residential diversion rate of 36%.

The City has also completed a Biosolids Management Study. The objective of the study was 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 Notice of Completion was published in May, 2015 and the City is now moving forward with its implementation which will effectively divert approximately 10,000 tonnes of waste annually.

1.5 City's Waste Supply Agreement with Elementa

In 2007, the EA work was deferred to allow a private waste-to-energy vendor, Elementa Group (Elementa) to develop and demonstrate a pilot scale facility within the City. The EA deferral was requested and approved by City Council to gain a better understanding of the role waste-to-energy may play in the City's future waste management strategy.

Elementa 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 at the conclusion of the testing, the City entered into a waste supply agreement to process a minimum 12,500 tonnes of residual waste per year commencing in 2011.

There were a number of delays and amendments to the timelines in the agreement between the City and Elementa. The most recent amendment, completed in May, 2015, included a construction start date that shall not extend beyond May 1, 2016 and an initial waste supply date of July 1, 2017. The May 1, 2016 construction start date was not achieved.

In December 2015, the City was advised that Elementa Group Inc. was in receivership proceedings. On June 13, 2016 Council indicated that formal notice should be provided to Elementa Group Inc. that the Waste Supply and Reformation Agreement between the two parties is terminated.

Given the risks associated with the project, it was assumed, within the context of this EA, that all residual waste will be managed through the solutions contemplated within this EA (i.e. Elementa will not process any of the City's residual waste). It was recognized that if the Elementa project were to be implemented and reached partial or full capacity, there would continue to be a need to manage residual solid nonhazardous waste from the Elementa facility and residual waste that cannot be processed by Elementa due to capacity constraints. It was recognized that the project would not impact the need for additional disposal capacity but may impact the capacity needed. Based on the conservative assumptions made in 2010, as noted above, these recent actions do not impact this EA.

1.6 Residual Wastes to be Managed

A report entitled *Waste Quantity Projections and Existing Environmental Profile* was prepared in June, 2010. The report estimated the future waste quantities requiring disposal within the service area. 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. These quantities were subsequently updated to include historical waste quantities from 2010 through 2014 together with updated population projections developed by City Planning staff in 2015. **Table 1.1** shows the estimated quantity of waste, by sector, that requires disposal in 2016 and 2055.

Table 1.1
WASTE REQUIRING DISPOSAL

	Residential (tonnes per year)	IC&I (tonnes per year)	Biosolids[1] (tonnes per year)	TOTAL (tonnes per year)
2016	22480	40340	10380	**73200**
2055	24330	45780	0	**70110**

Notes: 1. It is assumed that all municipal biosolids will be 100% diverted commencing in 2019.

Based on the projections over the 40 year planning period, the City of Sault Ste. Marie requires additional disposal capacity of approximately 2.33 million tonnes.

1.7 EA Planning Process

1.7.1 EA Activities

The EA planning process for this undertaking was described in the EA Terms of Reference. It is a phased sequence of activities as outlined below. Public, agency and Aboriginal Communities consultation was carried out throughout the project. The consultation program is discussed further in Section 9.0.

Description of the Problem/Opportunity – The description and purpose of the undertaking is described in this EA in Section 1.0. This activity included preparing waste quantity estimates for the City based on available population projections and per capita waste generation rates and waste disposal rates (discussed in Section 2.0). The waste quantities expected to be disposed of at the landfill were estimated and used to determine the approximate size of facility required and the potential effects on the environment.

Profile Existing Conditions – A general profile of the natural, socio-cultural, transportation and economic conditions within the service area was prepared as part of the EA in Section 3.0.

The purpose of this exercise was to establish a general knowledge of the baseline conditions within the service area. A draft report titled “Waste Quantity Projections and Existing Environment Profile”, June 2010, was prepared and posted on the City’s website. The contents of that report have generally been incoporated into this EA document with some updates.

Alternatives To – Alternative ways to manage waste were identified and evaluated. Alternatives considered included: do-nothing, increased diversion, incineration and high heat processes, export and landfill. Public input was obtained on the alternatives through a workshop in June 2007. The advantages and disadvantages of all the “alternatives to” were considered and a combination of diversion and landfill was identified as preferred. This decision and the process undertaken to reach it was documented in the report “Solid Waste Management Plan Environmental Assessment –

Alternatives to the Undertaking", June 2010. In June 2010, a Public Information Centre was held where the key elements of the report were presented and feedback was received. The "alternatives to" process and evaluations are included in Section 4.0 of this document.

Alternative Methods – New landfill capacity requires EA approval and alternative methods of landfilling were identified and evaluated in two steps. As a first step, the City considered the advantages and disadvantages of landfill expansion versus development of a new landfill site. Public input was obtained on these alternatives through a workshop held in April 2011. It was determined that expanding the existing landfill was preferred. This decision and the process undertaken to reach it were documented in the report "Alternative Methods – Step 1 (Landfill Expansion versus Development of a New Landfill Site)", April 2011, updated December 2014.

Step 2 involved the collection of data and evaluation of four alternatives to expand the site footprint. Data was collected on the four site expansion alternatives and presented in the "Alternative Methods – Step 2 (Identification and Comparison of Expansion Options)", February 2012 report. This information was subsequently presented to the public for review in at a Public Information Session in March 2012. As part of this step, landfill mining was also considered. Once a preferred footprint expansion was determined, an evaluation of that expansion with and without landfill mining was undertaken. This information was also presented in the February 2012 report and at the March 2012 Public Information Session. Using the data collected together with public input, the alternative expansion options were comparatively evaluated and the West and North Expansion B (Option 3) with landfill mining was identified as the preferred option.

The "alternative methods" process and evaluations are included in Section 5.0 of this document.

Description of the Preferred Project and Net Effects Assessment – A conceptual design for the West and North Expansion B option was prepared and assessed. Mitigation to minimize or eliminate negative effects was proposed and net effects (i.e. effects remaining after mitigation) identified. Any changes to the design to mitigate potential effects were incorporated. The conceptual facility design and the results of the net effects assessment were discussed at a Public Information Session conducted on February 9, 2016. This is discussed in Sections 6.0 and 7.0 of this document.

Impact Management Strategy – An Impact Management Strategy was prepared to guide the development and operation of the landfill expansion. The strategy included the recommended mitigation measures, monitoring and contingency measures, and a community relations plan. This is discussed in Section 8.0 of this document.

Documentation and Approvals – The EA planning process as well as the decisions made throughout this EA have been documented in a series of reports throughout the process. At each key point in the process, these reports were made available to the

public, agencies and Aboriginal Communities through the project webpage on the City's website. This EA document represents a compilation of all previous reports. This document will be made available as a draft for a 45-day public and agency review period. Following this review, the document will be finalized for submission to the Ministry of the Environment and Climate Change (MOECC) for formal approval.

1.7.2 Service and Study Areas

The service area for this EA includes the City of Sault Ste. Marie, Prince Township, and Batchewana First Nation's Rankin Reserve. However, in order to assess the potential effects of alternative methods, two site-specific study area(s) have been identified as follows:

- On-site study area – This is the land that will be required for the new on-site fill area.
- Off-site study area or site vicinitiy study area – This study area is used to define the area within which impacts may typically be experienced from landfill development or operational activities. This area is discipline specific, lies outside of the landfill footprint and typically extends a distance of 500 m to 2 km beyond the expanded fill area boundary.

The data collection and assessment of alternatives has been carried out based on these two study areas.

1.7.3 Planning Period

For the purpose of this EA, the planning period was considered to extend to 2055. The actual site life is dependent on waste generation rates, the success of waste diversion programs, growth in the study area and the success of the waste-to-energy initiative.

1.8 Consultation Program

Consultation played an important role in the EA process for this project. The consultation program was first developed as part of the EA Terms of Reference. The intent of the program was to provide opportunity for input from the public, stakeholders, Aboriginal Communities, and agencies at key points in the process. Efforts were made to provide information to the community to keep them informed, provide opportunity for people to obtain additional information and/or get their questions answered, and provide opportunity for discussion and exchange of information with the project team. The program was designed to be flexible to meet the needs of a variety of stakeholders.

Consultation on this project has included:

- Newsletters;
- Newspaper notices/advertisements;
- Media releases;
- Project Web page;

- Working papers at key points for public review and comment;
- Workshops;
- Public Information Sessions;
- Engagement with Aboriginal communities including Batchewana First Nations, Garden River First Nations, Metis Nation of Ontario and Missanabie Cree;
- Ongoing stakeholder liaison via phone, email, letter;
- Agency meetings; and
- Reports and televised presentations to Council.

Details on the consultation program and input received are provided in Section 9.0. The input received is also discussed for each key step within the chapters of this document.

1.9 The Study Team

The City assembled a multi-disciplinary study team to undertake the preparation of this EA. The project was managed by AECOM and many of the EA activities were jointly shared with Dillon Consulting Limited. Study Team members and their project responsibilities are shown in **Table 1.2**.

Table 1.2
THE STUDY TEAM

Study Team Members	Project Responsibilities
AECOM	• Overall project management; • Transportation assessment; • Socio-economic assessment; • Surface water assessment; • Planned land use assessment; • Visual assessment; • Geotechnical investigation and recommendations; • Waste quantities; • Design and operations input; and • Public and agency consultation.
Dillon Consulting Limited	• EA planning process; • Ground water assessment; • Biological assessment; • Air quality assessment; • Noise assessment; • Design and operations; and • Public and agency consultation.
Woodland Heritage Services Limited	• Archaeology and heritage assessment.

2.0 WASTE QUANTITIES PROJECTIONS

In order to determine the future waste quantities requiring disposal within the service area, a number of factors have to be taken into consideration including:

- Population projections;
- Waste generation rates or waste disposal rates; and
- Waste diversion rates.

The population projections are used in conjunction with waste disposal or waste generation rates to determine the quantity of waste to be managed by the City in future years.

In 2010, the City of Sault Ste. Marie issued the *Waste Quantity Projections and Existing Environmental Profile* report. That report provided information on population projections, waste generation rates and diversion rates used in order to estimate future waste quantities. Projections were completed for residential, IC&I, and biosolids wastes. The report was used as a basis for further analyses of waste quantities included in this report which includes consideration of more recent data over the period from 2010 to 2014. The following sections provide details of the waste quantity projections that have been incorporated into the project planning.

2.1 Population Projections

The City's population peaked in the early 1980's, and remained relatively stable in the range of 80,000 to 83,000 for a period of approximately 15 years. The population was generally in decline from the mid 1990's until the early 2000's and has rebounded moderately in recent years. The historical decline in population is largely attributable to industry downsizing and its ripple effect in the service and retail sectors.

In 2008 the City's Planning Department developed population and household projections in conjunction with its review of the City's Official Plan. City staff noted that the City's population is aging and there are not enough workers to fill future job vacancies created by retirements. This will create an opportunity for potential growth provided the municipality is able to attract migrants to fill job vacancies[3]. The report concluded that a modest population increase would occur from 2006 to 2026 and reach 81,500 in 2026. These projections were incorporated in the 2010 *Waste Quantity Projections and Existing Environmental Profile* report.

[3] Planning Division Report dated 2008 09 22 – Official Plan Review 2008 – Part 1 Population and Household Projections

Most recently, in 2015, the City Planning Division updated and tempered its population projections. For the purpose of this EA, the 2011 population was obtained from 2011 census data, and projected populations for 2016 to 2031 were obtained from the 2015 City Planning Report (refer to **Appendix A**). For the remainder of the planning period a modest population growth rate of 0.34% per annum (i.e. an extrapolation of the 2017 to 2031 average growth rate from the 2015 City Planning Division projections) was applied for the period from 2032 to 2055. The population projections are included in **Table 2.1**.

The existing and proposed service area also includes Batchewana First Nation's Rankin Reserve and Prince Township which comprise small populations in comparison to the City of Sault Ste. Marie. The estimated 2011 populations for each of these communities together with future population projections are also included in **Table 2.1**. Based on these projections, it is anticipated that the population within the service area will increase to 87,200 by 2055.

Table 2.1
SERVICE AREA (CITY OF SAULT STE. MARIE, PRINCE TOWNSHIP & RANKIN RESERVE) POPULATION PROJECTIONS

	2011	2016	2021	2026	2031	2036	2041	2046	2051	2055
Sault Ste. Marie	75140[1]	75,140[2]	76420[2]	77700[2]	78980[2]	80260[3]	81540[3]	82820[3]	84100[3]	85124[3]
Prince Township	1031[1]	1042[4]	1053[4]	1064[4]	1075[4]	1086[4]	1097[4]	1108[4]	1119[4]	1128[4]
Rankin Reserve	623[5]	662[5]	722[5]	883[5]	894[5]	905[5]	916[5]	927[5]	938[5]	947[5]
Total (Service Area)	76794	76844	78195	79647	80949	82251	83553	84855	86157	87199

Notes: 1. 2011 Census.
2. Preliminary Population & Residential Demand Projections, July 2015.
3. Extrapolated from Preliminary Population & Residential Demand Projections, July 2015.
4. Estimated 1 new household per year with an occupancy of 2.2 persons.
5. Numbers provided by Batchewana First Nations for a portion of the period and extrapolated.

2.2 Waste Generation/Disposal Rates

Three distinct waste streams are managed in whole or in part by the City of Sault Ste. Marie and include:

- Residential - wastes generated by people in their home environment.
- Industrial, Commercial and Institutional (IC&I) – wastes generated by people in work/business and institutional environments.
- Municipal Biosolids – wastes generated at waste water pollution control plants.

Population projections are used in conjunction with waste generation rates or waste disposal rates to determine the quantity of wastes to be managed by the City in future years. "Waste generation rate" is defined as the quantity of waste that is generated by

the average person within the service area on an annual basis and is expressed as kilograms or tonnes per person per year and includes diverted and disposed wastes. “Waste disposal rate” is defined as the quantity of waste that is disposed of by the average person within the service area on an annual basis and is expressed as kilograms or tonnes per person per year and it excludes diverted wastes.

In estimating the quantities of waste to be managed by the City in future years, waste generation rates have been applied for the “residential” and “municipal biosolids” waste streams and a waste disposal rate has been applied for the IC&I waste stream. Wastes diverted within the IC&I sector are mandated through Provincial Regulation and enforced by Provincial officers. IC&I diverted wastes are not controlled by the municipality and are managed almost entirely by the private sector. There is very limited information available to quantify diverted IC&I wastes. The application of a waste disposal rate for the IC&I sector reflects the wastes that have historically been managed by the City at its landfill.

The waste generation rate or waste disposal rate associated with each stream is discussed in greater detail in each of the following subsections.

2.2.1 Residential Waste Generation

The “residential” waste stream is characterized by the wastes that are generated in our home environment. The total estimated quantity of residential waste managed by the City of Sault Ste. Marie between 2005 and 2014 is summarized in **Table 2.2.**

Table 2.2
RESIDENTIAL WASTE GENERATION RATE

Description	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10Yr Avg.	5Yr Avg.
Residential Waste Managed	31250	31390	30350	32380	33770	33410	32260	35460	32380	30710	32340	32840
Population*	74500	74948	75200	75200	75300	75400	75140	75140	75140	75140	75110	75190
Kg/person/year	419	419	404	431	448	443	429	472	431	409	428	437

** Table reflects City of Sault Ste. Marie residents only.*
Data obtained from City of Sault Ste. Marie Data Calls.

The per capita residential waste generation rate over the ten year period 2005-2014 has ranged from 404 to 472 kg/person/year with 10 year and 5 year averages of 428 and 437 kg/person/year, respectively.

For the purpose of projecting the residential waste quantities, a waste generation rate of 450 kg/person/year has been used. It is 5% above the City of Sault Ste. Marie 10 year average and 3% higher than the most recent 5 year average. This moderately conservative approach is appropriate for planning purposes.

2.2.2 IC&I Waste Disposal Rate

The IC&I waste stream is characterized by wastes that are generated in our work/business and institutional (eg. schools, churches, etc.) environments. The City of Sault Ste. Marie does not have control over the management of wastes generated in the IC&I sector. IC&I waste is collected and disposed of or processed by private waste haulers and recyclers. Most of the IC&I waste disposal is accommodated at the City landfill due to the limited number of alternate disposal facilities available in the Sault Ste. Marie area.

For the purposes of this EA we have focused on the IC&I waste quantities that have historically been managed by the City (ie: disposal quantities only). The total quantity of IC&I waste disposed of within the City of Sault Ste. Marie landfill between 2005 and 2014 is summarized in **Table 2.3**.

Table 2.3
IC&I WASTE DISPOSAL RATE

Description	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10Yr Avg.	5Yr Avg.
IC&I Waste Disposed	39067	31610	30930	63714	33754	45539	41238	35071	34608	26550	38208	36601
Population*	74500	74948	75200	75200	75300	75400	75140	75140	75140	75140	75110	75190
Kg/person/year	524	422	411	847	448	604	549	467	461	353	509	487

** Table reflects City of Sault Ste. Marie residents only.*

The per capita IC&I waste disposal rate over the ten year period 2005-2014 has ranged from 353 to 847 kg/person/year with ten and five year averages of 509 and 487 kg/person/year respectively. Within the ten year time period a significant quantity of contaminated soil was landfilled in 2008 which contributed significantly to the 2008 anomalous quantity. Furthermore a significant quantity of waste was exported out of the City to a Northern Michigan landfill in 2014 which led to the significant reduction noted in the table.

As is evident from the data included in **Table 2.3**, there is the potential for considerable volatility in the quantities and types of IC&I waste to be disposed of at a City of Sault Ste. Marie disposal facility. As an example, in the Organic Waste Diversion Report (April 2001) it was concluded that approximately 75,000 tonnes of organic wastes (residential and IC&I) were generated within the City in 2000, of which approximately 30,000 tonnes were managed in the City's waste stream. The remainder was managed by the private sector.

Recognizing the variability in the quantities of IC&I waste that will be managed by the City, a reasonable contingency is required in the IC&I waste disposal rate. Therefore, the waste disposal rate to be used for projecting the IC&I waste stream is 525 kg/person/year. It is 3% above the City of Sault Ste. Marie 10 year average and 8% higher than the most recent 5 year average which incorporates some waste exporting. The proposed 525 kg/person/year was reached or exceeded in 3 of the ten years included in **Table 2.3**.

2.2.3 Municipal Biosolids Waste Generation

Municipal biosolids are currently being generated within the service area at waste water pollution control plants. This material is also commonly referred to as sludge. The total quantity of municipal biosolids managed by the City of Sault Ste. Marie between 2005 and 2014 is summarized in **Table 2.4**. These municipal biosolids are generated at the two City of Sault Ste. Marie water pollution control plants.

Table 2.4
MUNICIPAL BIOSOLIDS WASTE GENERATION RATE

Description	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10Yr Avg.	5Yr Avg.
Biosolids Waste Generated	9833	8474	10079	8662	10257	10215	10144	9687	9415	10533	9730	9998
Population*	74500	74948	75200	75200	75300	75400	75140	75140	75140	75140	75110	75190
Kg/person/year	132	113	134	115	136	135	135	129	125	140	130	133

** Table reflects City of Sault Ste. Marie residents only.*

In 2006, one of the two waste water pollution control plants was converted from primary treatment to secondary treatment and in 2008 problems were experienced with sludge management at the plant. The post 2008 quantities are likely the most representative of typical production under normal operations. Therefore the generation rate for municipal biosolids has been established at 135 kg/person/year which generally reflects the most recent 5 year average.

2.3 Waste Diversion Rates

The wastes that are generated within the service area are either diverted or disposed. This section addresses the waste diversion rates that have been achieved from 2005 to 2014 and projects future waste diversion rates. As with waste generation/disposal rates, diversion rates for the three streams have to be identified separately. Each is discussed in greater detail in the following subsections.

2.3.1 Residential Waste Diversion Rate

Over time, different waste diversion goals and objectives have been identified by the governments of the day. The common theme has been, and continues to be, for Municipalities to reduce disposal through enhanced 3R's initiatives. It has also been recognized that consideration must be given to cost factors and economies of scale. Some of the Provincial goals and objectives that have been identified during the conduct of this study are presented in the following paragraphs.

Ontario's Waste Diversion Act 2002 (WDA) is the legislation that governs various waste-diversion programs such as the Blue Box program, Household Hazardous Waste (HHW) program, the Waste Electrical and Electronic Equipment (WEEE) Program and the Used Tires Program.

In MOECC's June 2004 Discussion Paper, it was outlined that mandatory diversion targets for municipalities could be phased in. The approach proposed was as follows:

- Largest municipalities with populations over 250,000 could have a waste diversion target rate of 60% by 2008; and
- "Medium-sized" municipalities with populations over 50,000 and less than 250,000 could be given a lower interim waste diversion target, achieving 60% diversion over a longer period of time.

In order to improve diversion rates in Municipalities, the Ontario government determined that the legislation needed some changes. In June 2013, the government released a Waste Reduction Strategy and submitted Bill 91, the *Waste Reduction Act (2013).* The Act emphasized Extended Producer Responsibility programs with an aim to encourage producers to make their products more easily recyclable and to internalize the costs of product disposal instead of it being the responsibility of Municipalities. The Act had other significant changes including increasing producer contributions to the Blue Box recycling program, increasing waste diversion efforts in IC&I sectors and further enforcement and penalties against producers and intermediaries who did not comply. The Act was debated on sixteen sessional days but Bill 91 was not continued after the second reading.

Most recently the Government has passed the Waste-Free Ontario Act (2016) which includes a draft Strategy outlining a resource recovery and waste reduction road map for Ontario.

Although, to date, there have been no mandated waste diversion targets for Municipalities, it is evident, that there continues to be a provincial focus on reducing disposal quantities through 3R's initiatives.

To this end, the City of Sault Ste. Marie has completed a significant level of study relating to waste diversion in the City of Sault Ste. Marie. This has included *The*

Current Waste Management System Summary (September, 2000), a *Residential Waste Composition Study (March 2001)*, the *Organic Waste Diversion Report (April, 2001)*, the *Alternative Waste Diversion/Collection System Options Report (June 2001),* the *Co-composting Pilot Study (February, 2004)* and the *Biosolids Management Study (May 2015).*

The City has been very proactive with waste diversion since 2001. Their residential waste diversion rate has increased from 9% in 1999 to 36% in 2014. The City remains committed to cost effectively enhancing diversion efforts over time. There are however challenges associated with the City's northern climate and its location which limits its ability to partner with other municipalities to achieve economies of scale.

A waste audit was completed in Sault Ste. Marie in 2006 by Stewardship Ontario. The audit included the single family residential and multi-family residential sectors and included collection in each of the four seasons of the year. Based on the results of that study the capture efficiency in the single family residential recycling program was 79% and recyclable materials make up approximately 36% of the curbside residential waste stream. In comparison, the capture efficiency in the multi-family residential recycling program was approximately 51% and recyclable materials make up approximately 38% of the curbside multi-family residential waste stream. The estimated overall capture efficiency in the residential (single and multi-family) blue/yellow box program was 75%.

The City also provides bi-weekly collection of leaf and yard waste throughout the growing season. Leaf and yard waste made up approximately 7% of the curbside single family residential waste stream and 1-2% of the multi-family residential waste stream according to the 2006 waste audit.

The City has established a goal to achieve 80% capture efficiency in their residential recycling program and residential leaf and yard waste program. This reflects a target curbside waste diversion rate of 34%.

The curbside waste stream represents an estimated 65% to 70% of the overall residential waste stream. The remaining 30% to 35% is attributed to the public drop-off at the landfill, backyard composters, recycling depots/events, the household hazardous waste depot and deposit return programs.

There are also other diversion opportunities available to residents in addition to the leaf and yard waste program and recycling program. Other programs include separation of recyclable materials at the landfill (metals/white goods, batteries, propane tanks/cylinders, tires, clean wood waste WEEE and other recyclables), the Household Hazardous Waste Depot, Community Recycling Depot, an annual Christmas tree event coordinated by Clean North, use of backyard composters and a deposit return program. These programs have contributed an estimated average of 15% to the residential waste diversion rate over the period from 2005 to 2014.

Waste disposal at the landfill public drop-off area is closely supervised by City staff to ensure recyclable materials are properly separated. The other programs noted in the foregoing paragraph are well established, and typically represent relatively small quantities of waste diverted. Only a marginal enhancement in the overall residential waste diversion rate is likely possible through these programs in the future.

The overall residential diversion rate that can likely be achieved with 80% capture efficiency in the leaf and yard waste and recycling programs is 38% (i.e.: 23% through recycling and leaf and yard waste program plus 15% through other programs).

In order to achieve higher levels of residential diversion, the current organics collection program consisting of the collection of leaf and yard waste throughout the growing season would have to be expanded to year round weekly collection of kitchen wastes and other organics. Recognizing that organic materials represent a significant proportion of the overall waste stream, the City completed an *Organics Diversion Report (April 2001)* and a *Co-composting Pilot Study (February 2004)*. The conclusions included in the Co-composting Pilot Study are summarized below:

- It is recommended that the City implement an enhanced leaf and yard waste program in 2004. This program would consist of curbside collection every other week between April and November. The City has implemented this recommendation.
- It is recommended that the City not compost other residential and IC&I organics at this time. The rationale for the recommendation was that with the relatively small quantity of feedstock, the material would have to be composted outdoors to be cost effective. With the colder climate, snow loads and odour concerns, outdoor composting would be a challenge. The City will however continue to evaluate the costs and benefits of establishing a source separated organics program in the future.
- It is recommended that the City not compost municipal biosolids at this time. The rationale for the recommendation was that the City's biosolids do not meet the feedstock restrictions and cannot meet the unrestricted use guidelines included in the compost guidelines. The City subsequently completed a Biosolids Management Study. Through that study, alternatives were developed and evaluated to divert biosolids from disposal. The City is proceeding with the initial implementation stages to divert biosolids from disposal by 2019.

For the purposes of this study it has been assumed that the future residential waste diversion rate will reach 38% by 2019 and remain stable throughout the remainder of the planning period. This diversion rate reflects further enhancements to the currently approved diversion programs. Although the maximum diversion rate established in this study is 38%, the City is committed to progressively increasing diversion beyond 38% provided further additions/enhancements can be achieved practically and cost efficiently and are provincially mandated or approved by Council.

In 2007, The Elementa Group (Elementa) constructed a pilot-scale steam reformation plant that converts municipal solid waste into a char and synthetic gas (syngas). Testing of the technology, with limited quantities of municipal solid waste, was completed over a three year period from 2007 to 2009. The syngas was burned in a flare and testing of the emissions was completed with favourable results. Elementa subsequently requested that the City enter into an agreement to supply municipal solid waste to support the construction of a larger-scale plant.

Late in 2009, the City of Sault Ste. Marie endorsed a contract with Elementa for the supply of a minimum 12,500 metric tonnes of municipal solid waste for a minimum period of 10 years commencing in 2011. The contract would assist the City in managing its problem of diminishing solid waste disposal capacity. Elementa also planned to source waste from outside Sault Ste. Marie to allow full utilization of the proposed plant capacity.

It was recognized that based on the original proposed design capacity provided to the City, that the Elementa Plant would be unable to process all waste currently being managed at the Fifth Line landfill site. The City is currently disposing of approximately 50,000 to 60,000 tonnes per year (inclusive of contaminated soil and sewage sludge). Furthermore the Elementa process would generate some residual waste that would require landfilling. The City also recognized that with any new waste management technology, in its infancy, there are risks associated with its implementation. The City intended to mitigate these risks by ensuring an alternative means would be available for the disposal of residual waste. It was assumed that all residual wastes would require management by the City (i.e. no waste will be processed by Elementa). In the event that Elementa was partially or fully successful, it was recognized that the quantity managed by the City would be reduced accordingly.

To date there have been a number of delays and amendments to the timelines in the agreement between the City and Elementa. More recently, in December 2015, the City was advised that Elementa Group Inc. was in receivership proceedings. On June 13, 2016 Council indicated that formal notice should be provided to Elementa Group Inc. that the Waste Supply and Reformation Agreement between the two parties is terminated. Based on the conservative assumptions made in 2010, these recent actions do not impact this EA.

2.3.2 IC&I Waste Diversion Rate

Diversion programs in the IC&I sector are mandated through Provincial regulations and enforced by Provincial officers. Based on a comparison of recent IC&I disposal quantities relative to disposal quantities in the mid-1990's coupled with information gathered in the preparation of the *Organic Waste Diversion Report (April 2001),* the recent diversion rate in the City's IC&I sector appears to be substantial.

For the purposes of this study, a specific target IC&I waste diversion rate has not been identified as it is not possible to accurately quantify the wastes that are being generated and managed within this sector. However, considerable success is currently being achieved in the diversion of wastes in the IC&I sector in Sault Ste. Marie. These successes are largely driven by market conditions for wastes and provincial policy. Although it is hoped that the present diversion levels can be sustained and enhanced it is prudent to make some allowances for fluctuations in IC&I disposal quantities in the future (refer to Section 2.2.2).

2.3.3 Municipal Biosolids Waste Diversion Rate

The City is committed to diverting municipal biosolids from disposal and has completed a Municipal Biosolids Management Study. Alkaline stabilization and composting were identified as the preferred processing alternatives and the City is now proceeding with the implementation phase of this project which will likely span from 2016 to 2019 for planning, vendor selection, design, construction and commissioning.

Given the City's commitment to diverting municipal biosolids an aggressive approach has been taken within the context of this EA. It has been assumed that all of the municipal biosolids will be diverted from disposal commencing in 2019 (i.e. biosolids diversion rate = 100%).

2.4 Waste Requiring Disposal

The Table included in **Appendix A** summarizes waste generation, diversion and disposal projections for the period from 2016 to 2056. Based on the projections, the City of Sault Ste. Marie requires additional disposal capacity of approximately 2.33 million tonnes to approximately 2055.

At the current rate of landfilling and based on recent surveys of the disposal site the existing disposal capacity is expected to be depleted in 2022.

2.5 Summary

The following conclusions are provided for this section:

- It is anticipated that the permanent population in the service area (i.e.: the City of Sault Ste. Marie, Prince Township and Rankin Reserve) will increase to 87,200 by 2055;
- A residential waste generation rate of 450 kg/person/year is used in the waste projections;
- A residential waste diversion rate of 38% is used in the waste projections for the period 2019 to 2055;
- An IC&I waste disposal factor of 525 kg/person/year is used in the waste projections;

- A municipal biosolids generation rate of 135 kg/person/year is used in the waste projections;
- It is assumed all municipal biosolids will be diverted commencing in 2019;
- Average maximum annual rate of disposal will be 73,200 tonnes (It is, however, recommended that the site Environmental Compliance Approval incorporates a moderately higher disposal rate to recognize the potential for annual fluctuations.); and
- Sault Ste. Marie requires approximately 2.33 million tonnes of additional capacity to 2055.

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

A general inventory of the environmental conditions within and adjacent to the City of Sault Ste. Marie is provided in the following subsections. More detailed information on the existing environment at and near the existing disposal site is included in the discipline specific technical reports.

3.1 Natural Environment

The service area includes the City of Sault Ste. Marie, Prince Township, and Batchewana First Nation's and Rankin Reserve. The service area is characterized by St. Marys River valley area and the Precambrian Uplands whose two most prominent features are the shorelines of Lake Superior and the St. Marys River and the southern limit or rock face of the Precambrian Uplands. The shoreline defines the southerly limits of the communities, while the southerly boundary of the Precambrian Uplands defines the northerly limit of urban expansion. Within the study area there are a number of rivers and streams with a southerly flow to the St. Marys River. There are a number of wetlands and forested areas that provide habitat for a variety of flora and fauna.

The Algonquin and Nipissing lowland plateaus created by various prehistoric lake levels define the form of the community. The lowland plateaus have two levels with the first extending from the river level to several metres above the river level and the second being approximately 30m higher. The northern edge or the upper plateau contains significant aggregate deposits. The area of the aggregate deposits functions as the recharge area for a groundwater aquifer. The groundwater aquifer is the primary source of drinking water for a large rural community and supplies a portion of the municipal water supply capacity. The remainder of the municipal water supply capacity is sourced from Lake Superior. The rocky uplands area has the potential for the development of recreational opportunities as well as mineral and forestry resource extraction.

3.1.1 Geology / Hydrogeology / Soils

The northern portion of the study area, known as the Precambrian Uplands, is characterized by a rocky, rugged terrain with a very shallow overburden overlaying Precambrian granites. The southern portion of the study area consists of the Algonquin and Nipissing lowland plateaus created by prehistoric lake levels. The plateaus are relatively flat areas located between the St. Marys River and the Precambrian Shield. The interface between these plateaus and the upland area contains significant prehistoric sand and gravel beach deposits. These deposits form the main recharge area for the groundwater aquifer which flows under the plateau areas. Streams and rivers originating in the uplands are fed by rainfall and spring melt. These streams and rivers recharge the groundwater aquifer due to infiltration through the sand and gravel deposits at the base of the Precambrian Uplands.

The bedrock formations within the study area consist primarily of Precambrian granite and Cambrian sandstone. These bedrock formations typically define the lower limit of the aquifer. The main aquifer is located within the layers of till, sand and gravel directly above the bedrock. A large portion of the plateau area between the St. Marys River and the sand and gravel areas abutting the uplands has a layer of glaciolacustrine clay. This clay layer helps to protect the aquifer by limiting any downward migration of pollutants. The upper strata of overburden consisting of sand, gravel or alluvium deposits provide for the recharge and discharge of the aquifer. General stratigraphic units within the service area are summarized in **Table 3.1**.

Table 3.1
GENERAL STRATIGRAPHY

Type of Formation	Description	Comments
Overburden	Recent alluvium	Mainly found along and within the streambeds
	Glaciolacustrine beach sands and gravel	Along and adjacent to the slopes of the Precambrian uplands
	Glaciolacustrine shallow water sand	Discontinuous
	Glaciolacustrine deep water clay	Extensive over large part of the low lands surrounding the city of Sault Ste Marie, provides protection to the underlying aquifer
	Sand and gravel	Principal aquifer
	Till	Discontinuous
Bedrock	Cambrian sandstone	Bedrock aquifer, generally contiguous to overlying sand and gravel aquifer
	Precambrian granite	Upper fractured and weathered portions may provide limited groundwater source

Source: Burnside, 2003

3.1.2 Surface Water

The service area is located within the St. Marys River watershed. While there are only 4 (four) small lakes within the area there are a large number of small ponds. There are 7 (seven) main water courses that flow through the area. The tributaries, creeks and rivers have their source in the Precambrian Uplands and flow in a southerly direction to the St. Marys River. The 4 lakes are; Walls and Prince Lakes in Prince Township and Allard and Nettleton Lake in Sault Ste. Marie. The 7 major watercourses are; the Big and Little Carp Creeks, the East and West Davignon Creeks, Bennett Creek, Root River and Crystal Creek.

The quality of surface water in the area is generally good. Prince Lake is the only lake in the area that is extensively developed with both seasonal and year round residences.

There are very few uses within the study area that use surface water for domestic purposes. These would be found in the Prince Lake area where some residences take water from the lake. In addition, the occasional older residence along the upper St. Marys River may depend on river water for domestic usage. A portion of the city water supply capacity for the serviced urban area comes from a surface water intake located in Lake Superior at Gros Cap in Prince Township.

3.1.3 Climate

The service area is located along the eastern end of Lake Superior thus it is on the windward side of the Lake. The study area is located in the western part of the Sudbury climatic region. The growing season is longer relative to most of Northern Ontario. However, the lack of heat units significantly limits the growing of crops such as corn. (source: Chapman, Thomas 1986). Climatic data for the area is summarized in **Table 3.2**.

Table 3.2
CLIMATE DATA

Description	Value
Average annual temperature [1]	4.7° C
Average maximum July daily temperature [1]	24.2° C
Average minimum January daily temperature [1]	-14.8° C
Average maximum January daily temperature [1]	-5.0° C
Average minimum annual temperature [1]	-0.6 ° C
Average maximum annual temperature [1]	10 ° C
Mean date last day of frost in spring [2]	May 31
Mean date first day of frost in fall [2]	Sept. 18
Mean annual corn heat units [2]	2,000
Annual rainfall [1]	897.7 mm
Annual snowfall [1]	320.7 cm
Average wind speed [1]	12.4 k/hr

Source 1 - Weatherbase.com
2 – Chapman and Thomas 1968

3.1.4 Biology

3.1.4.1 Vegetation

The study area is within the Algoma section of the Great Lakes/St. Lawrence Forest Region. This district is characterized as having sugar maple and yellow birch as the dominant tolerant hardwood species within the Precambrian Uplands (source: Hills Eco Regions (Hills, 1957)). Areas south of the uplands are characterized by agricultural and urban disturbances and have species such as white birch, aspen, and pin cherry forest stands. The Algonquin and Nipissing lowland plateaus have soils suitable for hay crops and pasture land.

Red maple is found in many forest stands. Elm trees are also found in the area however the occurrences of elm are less frequent due to Dutch elm disease. Red pine is found in

drier soils primarily in the western portion of the study area near the airport. White cedar can be found on moist organic soils and some upland sites. Black spruce and tamarack can be found in lowland sites. Alder thickets are common along water courses.

While there are some forest stands south of the Precambrian Uplands they have limited commercial value. Woodlands cover approximately 40% of the city (source: Sault Ste. Marie Official Plan). Their location along water courses, ravines, and on slopelands makes them a valuable community resource. These stands provide habitat and corridors for wildlife, shade for fish habitat, stabilize soils mitigating erosion, and provide aesthetic relief within the urban setting.

There are two known provincially significant wetlands; one located at the mouths of the Carp Rivers, and the second larger wetland located to the northwest of the airport.

3.1.4.2 Wildlife

Wildlife in the study area is typical of that found in the Great Lakes/St. Lawrence Region surrounding urban centers. Moose, the largest animal species, and black bear are found in the Precambrian Uplands. Whitetailed deer are found in the forested portions of the plateau lands south of the Uplands. Species with extensive territorial ranges such as fisher, marten, gray wolf, bobcat and lynx may also be present within the study area, however, such sightings become rarer with urban expansion.

Common small mammals such as snowshoe hare, eastern gray and red squirrels, chipmunks, beaver, muskrat, porcupine, red fox, raccoon and skunk are also found throughout the study area.

The area forest stands are the home to many species of birds. A majority of these bird species are migratory, and are only present during the spring, summer and fall months when they nest and breed and raise their young. Migratory birds can fall into two main groups: short distance migrants, or those birds that only migrate as far south as the United States; and long-distance migrants, or those birds that spend their winters in tropical climates. Short distance migrants include such species as American robins, great blue herons, bald eagles, American crows, winter wrens, and several types of sparrows. Long distance migrants include peregrine falcons, warblers, ruby–throated hummingbirds, and swallows.

Some bird species have adapted ways to survive the long winter months. These year-long residents of the boreal forest include nuthatches, chickadees, common ravens, and several species of owls.

3.1.4.3 Fisheries

The study area abuts Lake Superior to the west and the St. Marys River to the south. Both bodies of water are important fish habitat for recreational sport and commercial fish species such as lake trout, rainbow trout, brook trout, pacific salmon, atlantic salmon, lake whitefish, lake sturgeon, yellow walleye, northern pike, small and large mouth bass,

and yellow perch. While the creeks and streams provide habitat for coldwater fish such as brook trout they are not extensively used for recreational fishing.

3.2 Social – Cultural Environment

The study area has a long history of prehistoric and historic settlement. The jurisdictional boundaries include the City of Sault Ste. Marie, the Township of Prince and Batchewana First Nation's Rankin Reserve.

3.2.1 Archaeological / Cultural

The study area has been inhabited since the time the glaciers retreated some 10,000 years ago. They left behind the landscape and contours that characterize the study area. The melt waters created a spillway for Lake Minong the forerunner of Lake Superior. At the location of present day Sault Ste. Marie the drainage outlet formed the old raised cobble and gravel beaches at the southern edge of the Precambrian Uplands. It is on these beaches, 45 metres higher than the present level of Lake Superior, that the first signs of human habitation appear. As the water levels receded the lands along the St. Marys River provided resources and an effective means of transportation for early inhabitants. The abundance of fish in the river and the rapids provided an abundant food source that attracted and sustained Aboriginal settlement of the area which has enjoyed continued human occupation for 4000 years.

The early French explorers called the Ojibwe people in the area "Saulteurs" (People of the Rapids). In the 1600's the river was part of the trading and exploration route west in search of a route to the Orient and a route of commerce for the fur trade. In addition to the fur trade the search for copper deposits and the abundant supply of timber contributed to the European settlement of the area. The ease in rafting large volumes of logs down the Lake Superior shoreline made Sault Ste. Marie a center for the area's lumber industry.

The growth of the City as an industrial center began in earnest with the arrival of Francis H. Clergue and the Canadian Pacific Railway in the 1890's. The formation of the steel works and the electric power generating station transformed Sault Ste. Marie from a wilderness outpost to an industrial center.

The Sault Ste. Marie Official Plan includes some cultural and heritage specific policies and Schedule E – "Archaeological Resources" highlights areas within the City that may have archaeological potential. In addition the Ministry of Tourism, Culture and Sport maintains a confidential list of all registered archaeological sites in the area. It is on file in the Community Development and Enterprise Services Department of the City of Sault Ste. Marie. These resources were referenced for site specific evaluations completed within the context of this EA.

3.2.2 Social-Cultural

Based on 2011 census data there were an estimated 32,520 households in Sault Ste. Marie. Based on the stability of the population since 2011 it is reasonable to assume that the number of households has also remained relatively stable. The most recent household projections for the City of Sault Ste. Marie were summarized in a report completed by the City's Planning Department in 2015. The estimated new housing starts from 2016 to 2031 are expected to range from 100 to 150 households per year with an average of 120 new starts per year. The number of households in the Township of Prince and the Rankin Reserve will, like the population, remain relatively stable throughout the timeline. A projected gain of one household per year would be a reasonable estimate of growth for these areas.

3.2.3 Official Plans and Policy Documents

The study area contains three local governing bodies, two have set out growth strategies within their planning and growth policy documents. The City of Sault Ste. Marie and the Township of Prince have adopted Official Plans. The Rankin Reserve does not have a similar document.

The Township of Prince's Official Plan was updated and approved in January 2012. Its growth policies reflect its rural setting. Development criteria maintains the character of existing development, protects the natural and social environment, and is sensitive to the financial well being of the municipal government. The Township sets out policies to guide development in a variety of land use types.

While there are no existing waste disposal sites within the Township boundary, the Municipal Servicing Network section of the OP notes that garbage is collected via roadside collection, and disposed of in the Sault Ste. Marie landfill. It also references this ongoing Waste Management EA and notes resulting impacts to their existing waste management practices will be reviewed by the Township and any amendments will be incorporated into the Official Plan once the study is completed. The OP also highlights that the principles of "reduce, reuse, and recycle" will be encouraged, and practiced wherever feasible.

The City of Sault Ste. Marie's Official Plan was adopted in 1996. A major update was approved in July of 2005 (Amendment # 100). Amendment #100 implemented many of the recommendations of the Sault Ste. Marie Groundwater Management and Protection Study (Burnside 2003). The Official Plan policies impact how land can be used in areas sensitive to development such as:

a) Groundwater recharge area;
b) Aggregate deposits;
c) Wildlife habitat;
d) Alluvial and lacustrine clay soils;
e) Fish habitat;
f) Precambrian uplands;

g) Great Lakes and tributary flood lines;
h) Wetlands;
i) Conservation Authority fill regulated areas;
j) Wellhead protection zones; and
k) Rural areas.

The above noted areas are illustrated on Schedules A, B and C of the Sault Ste. Marie Official Plan which are included in **Appendix B** of this report.

There is no mention of a landfill or waste disposal site as a permitted use within any of the Official Plan land use policies or within the designations as illustrated on Schedule C – Land Use. Any new waste disposal site or enlargement to the boundaries of the existing landfill site will require an amendment to the Official Plan.

The Municipal Services section of the Sault Ste. Marie Official Plan has the following policies with respect to waste disposal and landfill:

> S.2 The existing sanitary landfill site has a projected capacity sufficient to meet the needs of the municipality within the timeframe of this Official Plan. Identification of a new site may be required within the period of the Plan
> S.3 The city shall encourage the development of recycling programs and operations which divert solid waste from the landfill site.

3.2.4 Land Use

The major concentration of developed land is located within the Urban Service Line which occupies approximately 62 square kilometres. Rankin Reserve, Prince Township and the rural area of the city occupy approximately 266.5 square kilometres.

The existing waste disposal site is serviced with municipal water and waste water services but is generally located outside of the urban service line.

The land-use patterns within the City are illustrated on Schedule C of the Sault Ste. Marie Official Plan which is included in **Appendix B.**

3.2.5 Transportation

The service area is well connected to the rest of North America. It is located at the midpoint of the TransCanada Highway and connected to the United States Interstate Highway network via the International Bridge and Interstate 75. Rail connections exist to the north, south and east. The Sault Ste. Marie Airport is serviced by Air Canada Jazz, Porter Airlines and Bearskin Airlines offering flights to southern and northern Ontario destinations. In addition the service area abuts the Sault Locks which afford a navigable connection between Lake Superior and Lake Huron on the St. Lawrence Seaway.

Within the City of Sault Ste. Marie there are approximately 587 km of roads. The major street network is shown on Schedule D of the Sault Ste. Marie Official Plan which is included in **Appendix B**.

3.2.6 Municipal Servicing Network

a) Waste Management System

The City provides a combination of diversion and waste disposal services and facilities. An overview of the services provided is included in Section 1.4.

b) Sanitary / Storm Sewers

The urban land uses within the study area are served by a system of sanitary and storm water sewers. Sanitary sewage flows to two secondary treatment plants. The West End Waste Water Treatment Plant located at the corner of Allen's Side Road and Base Line has a design capacity of 20 ML (megalitres) per day. The East End Waste Water Treatment Plant has a design capacity of 36 ML per day. Over the years the municipality has eliminated combined sanitary and storm sewers. Some inflows and infiltration of storm water into the sanitary system still occurs during significant rainfall events and as a result of spring melt. To address this, the city constructed a 12,000 cubic metre and a 700 cubic metre combined sewage overflow tank at Bellevue Park and the Pim Street pump station respectively. The "holding" tanks temporarily store waste water during spring melt or significant rainfall events mitigating overflows within the collection system.

In addition to the communal sanitary sewage system, waste water is managed through private, on-site systems in the rural areas.

A survey conducted for the Sault Ste. Marie Groundwater Management Study (2003) found approximately 1,350 individual septic systems in the unserviced rural area.

c) Domestic Water

The municipal domestic water supply has two primary sources; a water intake located in Lake Superior at Gros Cap and the groundwater aquifer via four municipal wells at three locations in the City.

In addition to the potable water provided through the communal system, it is estimated that there are approximately 1960 individual wells in the study area (source Sault Ste. Marie Regional Conservation Authority (SSMRCA) from MOECC well records).

3.2.7 Economics

Sault Ste. Marie has made a name for itself in steel making. Essar Steel is its major employer with approximately 2500 to 3000 employees. Algoma Tubes which produces seamless steel tubes, typically employs approximately 400 persons. Forestry is also a major contributor to the local economy employing approximately 400 people.

3.2.8 Tourism and Recreation

Tourism and recreation opportunities in the area include sport fishing and water sports along the St. Marys River, Lake Huron and Lake Superior, hiking on the Voyager Trail, snowmobiling, cross-country and downhill snow skiing in winter months, and golf. In addition tourist and recreation activities such as hunting, fishing, skiing, and eco-tourism in surrounding areas contribute to the local economy and employment in the accommodation, food, and retail industries.

3.2.9 Forestry

There are large forest stands within the Precambrian Uplands area comprising primarily hardwoods such as sugar maple. Harvesting activity within the service area is minimal. It generally supplies small local mills and provides firewood for area residents. The large boreal forest to the north of the service area contributes to the local economy through the supply of, wood based resources to small local mills.

In addition the area provides support services to the forestry industry such as equipment sales and service, forest management offices, and homes for those employed in harvesting activities. The Forestry Research Centers on Queen St. East in Sault Ste. Marie house both federal and provincially funded laboratories dedicated to scientific research geared toward sustainable forestry.

3.2.10 Agriculture

Based on the 2011 census data the farms within the study area are generally smaller in size with relatively small revenues.

Seven farms are under 10 acres, fourteen farms are 10 to 69 acres, four farms are 70 to 129 acres and one farm is 180 to 239 acres.

Twenty-three farms reported gross sales under $10,000, five farms reported gross sales between $10,000 and $25,000, two farms reported gross sales between $25,000 and $50,000, four farms reported gross sales between $50,000 and $100,000, one farm reported gross sales between $100,000 and $250,000 and one farm reported sales between $1.0M and $2.0M.

Crops included oats at two farms, barley at one farm, corn at four farms, alfalfa at four farms, other tame hay and fodder crops at twelve farms, potatoes at five farms, buckwheat at one farm and other field crops at one farm.

A number of different types of livestock were reported in the 2011 census. Ten farms reported having an inventory of cattle or calves and the total number of animals for all reporting farms was 126. Other livestock included horses or ponies at 16 farms and goats at two farms.

3.2.11 Mineral Resources

The most significant mineral resource in the study area is the aggregate (sand and gravel) deposits located at the southern edge of the Precambrian Uplands. The aggregate extracted from the numerous licensed pits and quarries are necessary for development of the urban area.

The Primary Aggregate Area is illustrated on Schedule A of the Sault Ste. Marie Official Plan (refer to **Appendix B**).

There are no mines operating in the service area. However, mineral deposits of copper, zinc, and lead were mined in the early 1800's. Two old mining trenches can be found in Prince Township. One on the bluffs above Lake Superior north of Jackson Island and the other in the Precambrian Shield north of Marshall Drive. A third old trench can be found in Sault Ste. Marie north of the intersection of Connor Road and Sixth Line. There is an active Jacobsville Sandstone quarry along the Root River just east of Great Northern Road. There is also a potential for the quarrying of blast rock or bedrock aggregate in the Precambrian Upland area. One existing blast rock quarry is located north of Avery Road.

3.3 Existing Landfill

The municipal landfill site, located at 402 Fifth Line East, was developed, owned and operated by Cherokee Disposals and Construction Ltd. in the early 1960's. An Environmental Assessment (EA) was undertaken by the City of Sault Ste. Marie (City) from 1983-1984 to evaluate alternative means of providing long-term waste capacity for the City, Township of Prince and Batchewana First Nation Rankin Reserve. The recommended Undertaking was the expansion of the Cherokee Landfill Site which would give the site additional waste disposal capacity for approximately 20 years. The assessment was approved and a Provisional Certificate of Approval (C of A, now referred to as an Environmental Compliance Approval) was issued in March of 1989 "for the use and operation of 44.6 hectare waste disposal site (landfilling) within a total site area of 83.6 hectares". The landfill was purchased by the City in 1989 and currently is licenced to accept domestic, commercial, non-hazardous solid industrial waste and processed organic waste. In July 2009, the Provisional C of A was amended to include a 23.2 hectare contaminant attenuation zone adjacent to the western boundary. **Figure 3.1** is a site plan showing the principle onsite facilities and features. The site is operated by the City of Sault Ste Marie.

Earth Borrow Area

Stormwater Management Pond

Cover Stockpile Area

compost pad

Wood Waste Drop-off Area

Concrete pads for cardboard/paper roll off bins

Concrete bunker for construction and demolition waste

Canopies for batteries, propane tanks and recyclable containers

Tire drop-off Area

Public Drop Off

Maintenance Garage

Weigh Scales, Scale House and Administartion Bldg.

Household Hazardous Waste Depot

Blower Station

Leachate Collector

pump station

ROOT RIVER

Hydro Corridor

Cross Town

AECOM Canada Ltd.
523 Wellinton Street East, Sault Ste. Marie Ontario, Canada
P6A2M4 T705.942.2612 F705.942.3642

Legend:

- Purge Wells (pw-6)
- Methane Gas Monitor (M5)
- Monitoring Well and Id Number (62)
- Landfill gas wells and Piping (F4)
- Leachate Collector
- Internal Road Network

Note: Aerial photo taken Oct 4, 2010

Sault Ste. Marie Municipal Landfill Site

SITE PLAN

Proj. Manager: – RT	Drawn By: JT	Figure No.
Scale: 1:4000	Checked By: RT	3.1
Date Issued: – May, 2017	Project No: 60395	
Location: figure 1siteplan.dwg	File Name: G:\60395 –	

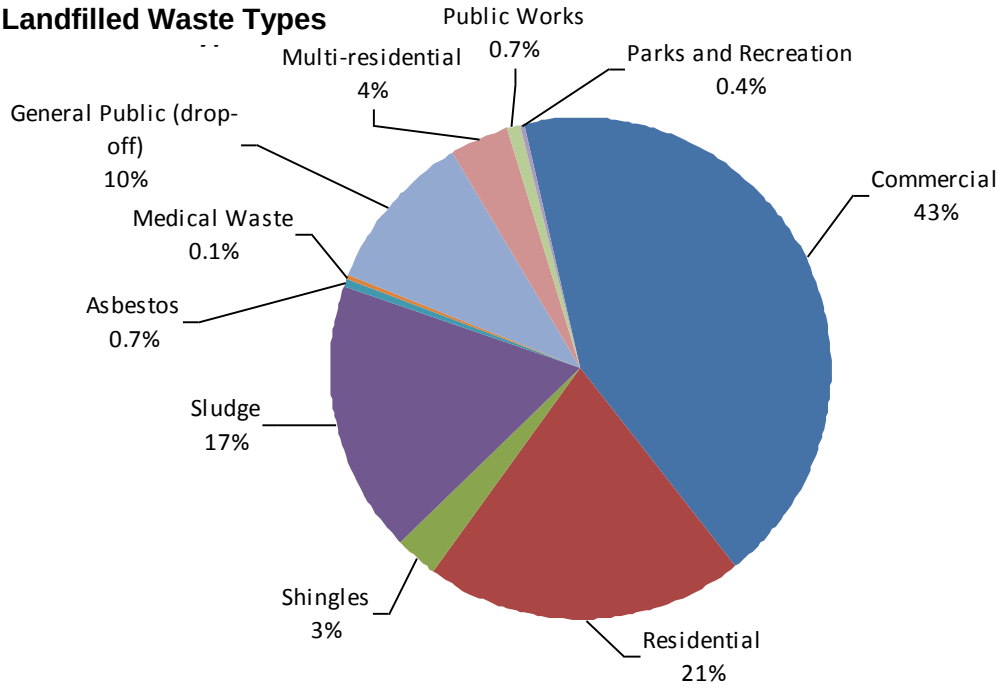
The C of A is supported by a Design and Operations Report (Cherokee Landfill Site, M.M. Dillon Limited, 1990) that was prepared to detail the site development, operation program and contingency program to mitigate unacceptable off-site leachate migration. Annual Site Development and Operations and Monitoring reports are submitted to MOECC to fulfill requirements of the C of A.

Approximately 62,600 tonnes of material were received at the landfill in 2014 of which about 52,200 tonnes was landfilled, 8,400 tonnes were soil materials that were used as cover or stockpiled for future use as cover and 2,000 tonnes were diverted from the site. There are extensive onsite facilities and features at the landfill, including:

- Public access road;
- Inbound and outbound weigh scales;
- Scale house;
- Leaf and yard waste compost processing area;
- Drop-off area for:
    - Municipal solid waste;
    - Metals including appliances;
    - Wood waste;
    - Tires;
    - Shingles, construction and demolition materials;
    - Batteries and propane tanks;
    - WEEE; and
    - Typical “blue box” recyclables.
- Administration building;
- Maintenance garage;
- Internal access roads throughout the disposal area;
- Surplus materials stockpiles;
- Purge wells;
- Gravity leachate collection system;
- Groundwater monitoring wells;
- Active landfill gas wells and associated piping network;
- Blower station and central flare for the active landfill gas system;
- Leachate pump station;
- Storm water management pond; and
- Household hazardous waste depot.

The site provides a “one-stop shop” that caters to a full range of waste management needs for residents and businesses in the service area. **Figure 3.2** provides a breakdown of the materials that were managed at the landfill site in 2014.

Figure 3.2 – Landfilled Waste Types



4.0 ALTERNATIVES TO THE UNDERTAKING

"Alternatives To" are practical options to address the need for additional waste disposal capacity for the City.

In June 2007 the City of Sault Ste. Marie issued a draft "Alternatives To" Working Paper as part of the EA process. That working paper described the "alternatives to" being considered for Sault Ste. Marie, the data collected for each alternative and the criteria that would be used to evaluate them. Input was obtained from government, the public, Aboriginal Communities and other stakeholders on the different alternatives for managing the City's municipal solid waste.

In the summer of 2010, it was decided that the optimal waste management alternative for the City was increased 3Rs (Reduce, Reuse, Recycle) and landfilling of residual waste. This was documented in the June 2010 report entitled "*Solid Waste Management Environmental Assessment – Alternatives to the Undertaking"*.

A high heat process was also included in the City's waste management plan through the City's contractual relationship with a private sector energy-from-waste proponent, The Elementa Group (Elementa). There were a number of delays and amendments to the timelines in the agreement between the City and Elementa.

In December 2015, the City was advised that Elementa Group Inc. was in receivership proceedings. On June 13, 2016 Council indicated that formal notice should be provided to Elementa Group Inc. that the Waste Supply and Reformation Agreement between the two parties is terminated. For the purposes of the "alternatives to" and "alternative methods" considered within the context of this EA, it has been assumed that all waste will have to be managed by the City through the solutions contemplated within this EA (i.e. no waste will be processed in a private sector waste-to-energy facility). Based on the conservative assumptions made, these recent actions do not impact this EA.

This chapter describes the "alternatives to" considered and the evaluation process to come to the above determination.

4.1 "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 MOECC in September 2005. The "alternatives to" that were considered in the EA are as follows:

- Increased Waste Diversion;
- Incineration and High Heat Processes;
- Landfill;
- Export of Waste Outside the Service Area; and/or

- Do-Nothing.

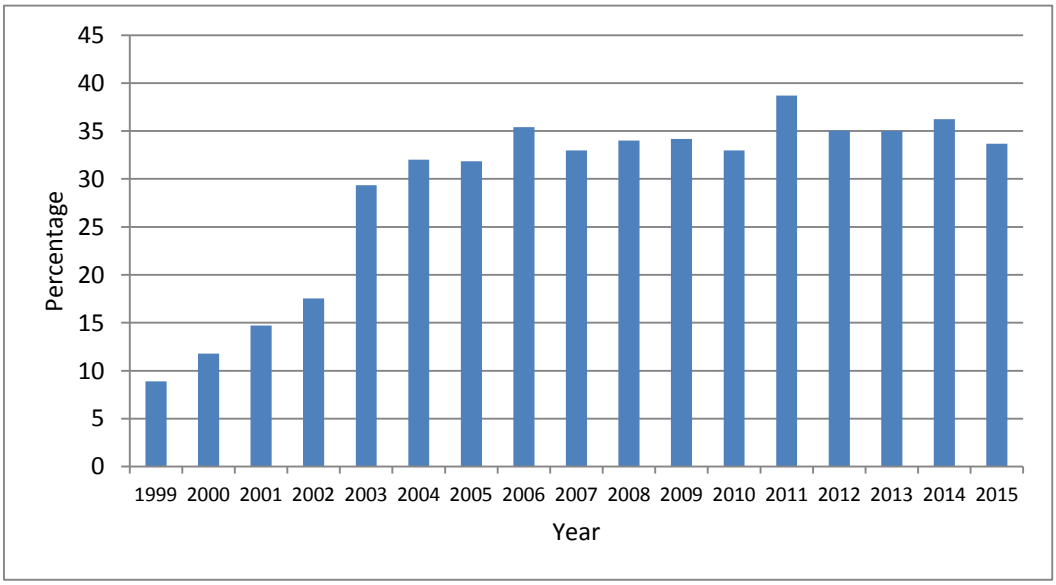
The following sections describe each “alternative to” option.

4.1.1 Increased Waste Diversion

The City of Sault Ste. Marie’s waste diversion system includes initiatives to reduce waste (i.e. plastic bags campaign, local “second hand” retailers and charities, reusable coffee cups); weekly collection of recyclables; bi-weekly collection and composting of leaf and yard waste throughout the growing season; a household hazardous 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 addition, the City reduced residential waste set out limits to 2 bags/containers per week per household in 2006. Tags for additional waste bags or containers must be purchased.

The residential waste diversion programs diverted approximately 36% of residential waste from the landfill in 2014. This is a significant increase compared to the 9% diverted in 1999. **Figure 4.1** shows how the City’s focus on enhancing diversion in the early to mid 2000’s was very successful in reducing its reliance on disposal.

Figure 4.1
Historical Residential Waste Diversion Rate for the City of Sault Ste. Marie



Over time, different waste diversion goals and objectives have been identified by the governments of the day as summarized in Section 2.3.1 and there continues to be a provincial focus on reducing disposal quantities through 3R’s initiatives as evidenced by the recent Waste-Free Ontario Act (2016). It has also been recognized that a “one size fits all” approach to waste management may not be suitable given the different

challenges that are faced by municipalities including climate, proximity to markets, and proximity to other municipal partners to achieve economies of scale, etc.

The City of Sault Ste. Marie has completed a significant level of study relating to waste diversion in City of Sault Ste. Marie. This has included *The Current Waste Management System Summary (September, 2000)*, a *Residential Waste Composition Study (March 2001)*, the *Organic Waste Diversion Report (April, 2001)*, the *Alternative Waste Diversion/Collection System Options Report (June 2001)* and the *Co-composting Pilot Study (February, 2004)* and the *Biosolids Management Study (May 2015).*

The City has been very proactive with waste diversion since 2001. Their residential waste diversion rate has increased from 9% in 1999 to 36% in 2014. The City remains committed to cost effectively enhancing diversion efforts over time. There are however challenges associated with the City's northern climate and it's location which limits its ability to partner with other municipalities to achieve economies of scale. The City's diversion programs are described in the following paragraphs.

The City collects recyclables from approximately 26,251 single family households and approximately 6,266 multi-residential units.[4] There is limited ability to increase diversion by adding additional locations to the program however there may be an opportunity to enhance the capture efficiency primarily through enhanced public education and possibly further reductions in waste setout limits. Further enhancements may also be possible through the addition of materials to the current recycling program.

A waste audit was completed in Sault Ste. Marie in 2006 by Stewardship Ontario. The audit included the single family residential and multi-family residential sectors and included collection in each of the four seasons of the year. Based on the results of that study the capture efficiency in the single family residential recycling program was 79% and recyclable materials make up approximately 36% of the curbside residential waste stream. In comparison, the capture efficiency in the multi-family residential recycling program was approximately 51% and recyclable materials make up approximately 38% of the curbside multi-family residential waste stream. The estimated overall capture efficiency in the residential (single and multi-family) blue/yellow box program was 75%.

The City also provides bi-weekly collection of leaf and yard waste throughout the growing season. Leaf and yard waste made up approximately 7% of the curbside single family residential waste stream and 1-2% of the multi-family residential waste stream according to the 2006 waste audit.

The City has established a goal to achieve 80% capture efficiency in their residential recycling program and residential leaf and yard waste program. This reflects a target curbside waste diversion rate of 34%.

[4] 2014 WDO Data Call

The curbside waste stream represents an estimated 65% to 70% of the overall residential waste stream. The remaining 30% to 35% is attributed to the public drop-off at the landfill, backyard composters, recycling depots/events, household hazardous waste depot and deposit return programs.

There are also other diversion opportunities available to residents in addition to the leaf and yard waste program and recycling program. Other programs include separation of recyclable materials at the landfill (metals/white goods, batteries, propane tanks/cylinders, tires, clean wood waste WEEE and other recyclables), the Household Hazardous Waste Depot, Community Recycling Depot, an annual Christmas tree event coordinated by Clean North, use of backyard composters, donations of used items to local charities and retailers and a deposit return program. These programs have contributed an estimated average of 15% to the residential waste diversion rate over the period from 2005 to 2014.

Waste disposal at the landfill public drop-off area is closely supervised by City staff to ensure recyclable materials are properly separated. The other programs noted in the foregoing paragraph are well established, and typically represent relatively small quantities of waste diverted. Only a marginal enhancement in the overall residential waste diversion rate is likely possible through these programs in the future.

The overall residential diversion rate that can likely be achieved with 80% capture efficiency in the leaf and yard waste and recycling programs is 38% (i.e.: 23% through recycling and leaf and yard waste program plus 15% through other programs).

In order to achieve higher levels of residential diversion, the current organics collection program consisting of the collection of leaf and yard waste throughout the growing season would have to be expanded to year round weekly collection of kitchen wastes and other organics. Recognizing that organic materials represent a significant proportion of the overall waste stream, the City completed an *Organics Diversion Report (April 2001)* and a *Co-composting Pilot Study (February 2004)*. The conclusions included in the Co-composting Pilot Study are summarized below:

- It was recommended that the City implement an enhanced leaf and yard waste program in 2004. This program would consist of curbside collection every other week between April and November. The City has implemented this recommendation.
- It was recommended that the City not compost other residential and IC&I organics at this time. The rationale for the recommendation was that with the relatively small quantity of feedstock, the material would have to be composted outdoors to be cost effective. With the colder climate, snow loads and odour concerns, outdoor composting would be a challenge. The City will however continue to evaluate the costs and benefits of establishing a source separated organics program in the future.
- It was recommended that the City not compost municipal biosolids at this time. The rationale for the recommendation was that the City's biosolids did not meet

the feedstock restrictions and could not meet the unrestricted use guidelines included in the compost guidelines in effect at the time. The compost guidelines were subsequently amended in 2012 and the City subsequently completed a Biosolids Management Study. Through that study, alternatives were developed and evaluated to divert biosolids from disposal. The City is proceeding with the initial implementation stages to divert all biosolids from disposal by 2019.

For the purposes of this study it has been assumed that the future residential waste diversion rate will reach 38% by 2019 and remain stable throughout the remainder of the planning period. This diversion rate reflects further enhancements to the currently approved diversion programs. Although the maximum diversion rate established in this study is 38%, the City is committed to progressively increasing diversion beyond 38% provided further additions/enhancements can be achieved practically and cost efficiently and are provincially mandated or approved by Council.

Although outside of its mandate, the City is also continuing to work with the MOECC, local service providers and the Industrial, Commercial and Institutional (IC&I) sector to encourage further diversion of IC&I waste from landfill. 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. As an example the City has had discussions with local coffee shops regarding the possible diversion of coffee grounds.

In summary the enhanced diversion alternative includes the following elements:

- Increased capture efficiency in the curbside recycling program through enhanced public education and possibly further reductions in waste setout limits;
- Collection of additional materials in the curbside recycling program as dictated by Provincial regulation and/or market conditions;
- processing, for beneficial use, all biosolids generated at the City's two wastewater treatment plants;
- encouraging and supporting diversion in the IC&I sector; and
- continuing to evaluate periodically, the costs and benefits of establishing a source separated organics program.

It is noted that even with aggressive diversion including the enhancements discussed in this section, disposal capacity is still required now and for the foreseeable future.

The approximate cost for increased diversion will vary depending on the diversion initiative. Public education for example will cost less to implement than a full scale biosolids processing facility.

The cost for increased diversion would be in the range of $45 to $170 per tonne[5].

4.1.2 Incineration and High Heat Processes

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 (CO2) 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.

Incineration (combustion) operates 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

The Elementa Pilot Project

In 2007, The Elementa Group (Elementa) constructed a pilot-scale steam reformation plant that converts municipal solid waste into a char and synthetic gas (syngas). Testing of the technology, with limited quantities of municipal solid waste, was completed over a three year period from 2007 to 2009. The syngas was burned in a flare and testing of the emissions was completed with favourable results.

Late in 2009, the City of Sault Ste. Marie endorsed a contract with Elementa for the supply of a minimum 12,500 metric tonnes of municipal solid waste for a minimum period of 10 years commencing in 2011. The contract would assist the City in managing its problem of diminishing solid waste disposal capacity.

It was recognized that based on the original proposed design capacity provided to the City, the Elementa Plant would be unable to process all waste currently being managed at the Fifth Line landfill site. Furthermore the Elementa process would generate some residual waste that would require landfilling. The City also recognized that with any new waste management technology, in its infancy, there are risks associated with its implementation. The City intended to mitigate these risks by ensuring an alternative means would be available for the disposal of residual waste. It was assumed that all residual wastes would require management by the City (i.e. no waste will be processed by Elementa). In the event that Elementa was partially or fully successful, it was recognized that the quantity managed by the City would be reduced accordingly.

To date there have been a number of delays and amendments to the timelines in the agreement between the City and Elementa. More recently, in December 2015, the City was advised that Elementa Group Inc. was in receivership proceedings. On June 13, 2016 Council indicated that formal notice should be provided to Elementa Group Inc. that the Waste Supply and Reformation Agreement between the two parties is terminated. Based on the conservative assumptions made in 2010, these recent actions do not impact this EA.

[5] The cost ranges presented in Section 4 of the EA were developed in 2010 and represent the values used at the time the evaluation of “Alternatives to the Undertaking” was completed.

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.

Single-Stage Mass Burn: This is a well-established technology that is commonly used in Europe in the United States. This technology was selected for the Durham-York facility that has been constructed and became operational in 2015. Generally, each mass burn combustion chamber can process in the order of 150 to 800 tonnes of waste per day based on the design.

Two-Stage Combustion: The Emerald Energy From Waste Inc. (formerly known as Algonquin Power) facility located in Brampton that combusts waste 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. New two-stage combustion facilities have not been developed as much 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.

High Heat Processes (Gasification and/or Pyrolysis) 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.

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.

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 MOECC 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 the United States and Europe, the MOECC expects that air emissions for new facilities will be significantly below limits in Guideline A-7.

4.1.3 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 3.1**). 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 licenced to accept domestic, commercial, non-hazardous industrial waste and processed organic waste. Approximately 62,600 tonnes of material were received at the landfill in 2014 of which about 52,200 tonnes was landfilled, 8,400 tonnes were soil materials that were used as cover or stockpiled for future use as cover and 2,000 tonnes were diverted.

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 391,000 m^3 in 2014. An active landfill gas collection and flaring system became operational in 2011. The collected gas is burned in a central enclosed flare. There may be an opportunity to use the collected gas for energy generation in the future subject to available incentives to support the business case.

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 2014 Site Development and Operations Report shows approximately 565,000 m^3 of disposal capacity (refuse and daily cover) remaining as of December 31, 2014. The site life is projected to extend to 2021-2022 based on future disposal rates and projected population growth.

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 therefore the EA assumed this in the evaluations.

Landfill mining was also 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 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 and 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.

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 may 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. 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. The 2014 tipping fee at the Sault Ste. Marie landfill was $70/tonne. The City also has a gate fee of $10.00 per vehicle for residential waste loads of less than 300 kg.

4.1.4 Export of Waste Outside of 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. 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 has increased in recent years. In Fiscal Year 2014, approximately 2.6 million tons of Canadian waste was disposed of in Michigan landfills[6].

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.

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.

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.

[6]http://www.michigan.gov/documents/deq/DEQ-OWMRP-SWS-SolidWasteAnnualReportFY2014._481071_7.pdf

4.1.5 Do Nothing

This alternative identifies what would happen if Sault Ste. Marie did nothing to respond to its future waste disposal needs.

Based on the 2014 Site Development Report, there is approximately 565,000 m^3 of disposal capacity (refuse and daily cover) remaining as of December 2014. Based on this estimate and estimated future disposal rates, the site life is projected to extend to 2021-2022. The “do-nothing” alternative would mean that by approximately 2022 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.

4.2 “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.

4.2.1 Evaluation Criteria and Approach

Table 4.1 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. Consultation carried out in this phase is discussed in Section 9.0 of this document.

To evaluate the “Alternatives To”, each of the alternatives were described based on the evaluation criteria noted in **Table 4.1**. 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.

Table 4.1 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.

4.2.2 "Alternatives To" Description and Ranking by Criterion

The following describes the evaluation of alternatives based on the evaluation criteria noted in **Table 4.1**. **Table 4.2** (at the end of the chapter) 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.

4.2.2.1 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 agreed with Michigan to eliminate residential waste export as of December 31, 2010.

Landfills, *incinerators/high heat processes* and *diversion* facilities (recycling or composting plants) all require Environmental Compliance Approvals (ECA) from the MOECC to operate. These ECAs 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 experience in other Ontario municipalities, applicable EAA and EPA approvals 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.

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 ceased residential waste export to Michigan as of 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.

4.2.2.2 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 typically 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 transfer station and 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).

4.2.2.3 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 as follows:

- 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 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 ceased residential waste export to Michigan as of December 31, 2010, removing this as an alternative that the City could implement. 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.

4.2.2.4 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, regulatory changes (i.e. ban on landfilling organics), 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, as demonstrated by the Waste-Free Ontario Act (2016). 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 (i.e.: 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. As an example some of the IC&I waste in Sault Ste. Marie is currently being exported to a landfill in northern Michigan. 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 lifespan. 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).

4.2.2.5 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 2014 the City of Sault Ste. Marie diverted 36% 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 (i.e.: 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).

4.2.2.6 Proven Technical Capability

This criterion compares alternatives based on 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.

4.2.2.7 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 recycling program. These costs are based on operating experience with these types of facilities. This alternative is ranked first for this criterion.

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.

Current fees at the Sault Ste. Marie *Landfill* comprise of a gate fee or tipping fee for residential customers and a $70/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 (i.e.: approximate site life of 30 to 40 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[7] 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.

4.2.3 Evaluation of "Alternatives To" Results

The rankings are summarized for each of the criteria in **Table 4.3** with a rank of first being preferred and a rank of fifth least preferred. The cells of the table have also been highlighted from darkest (preferred) to lightest (least preferred) to visually represent the ranking.

Table 4.3 clearly shows that the do-nothing alternative has no advantages for any of the criteria considered. The table also shows that the export alternative 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 4.3 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 and therefore requires another alternative to manage the remaining waste.

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

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.

Table 4.3
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

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[8]; whereas incineration/high heat process must be designed for the most reliable component of the waste stream

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

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 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.

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**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.
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:	Potential for environmental effects:	Potential for environmental effects:	Potential for environmental effects:	Potential for environmental

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

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
	• Some potential for nuisance impacts (noise, odour, dust, truck traffic)	• Some potential for nuisance impacts (noise, odour, dust, truck traffic)	• Some potential for nuisance impacts (noise, odour, truck traffic)	• Some potential for nuisance impacts (noise, odour, dust, truck traffic)	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 addition, engineered landfills include a liner and leachate management system that mitigates the potential for negative effects.	• Potential for impact on ground and surface water depends on the nature of disposal facility	• Limited impact to water
	Effects can typically be mitigated; significance of effect depends on	Most of the effects can typically be mitigated and the extent of impact	Most of the effects can typically be mitigated and the extent of impact depends on	Added environmental effects resulting from transfer station	Significant adverse impacts from illegal

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
	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.	depends on facility location.	facility location.	operations, haulage including air emissions from haul trucks, disruption of local residents and users of haul roads.	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 under the *Environmental Protection Act* and has been doing so for many years.	**Ranked First**: City is required to provide waste disposal, and has many years of experience with landfilling.	**Ranked Third**: City is required to provide waste disposal, and can consider incineration/high 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	**Ranked Fourth**: City is required to provide waste disposal and can export 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.	**Ranked Fifth**: City is required to provide waste disposal, therefore do-nothing is not acceptable.

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
			existing blue/yellow box recycling contract). This alternative involves a considerable learning curve for municipal staff.	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.	
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 and increased quantities through expansion and innovation. Changes to materials collected may require system modifications or upgrades.	**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 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	**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 flexibility for changing waste disposal quantities.	**Ranked Fifth**: There is no flexibility possible with the do-nothing alternative.

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
			other jurisdictions (e.g. Norway, Denmark).		
Capability of managing waste quantities and qualities	**Ranked Fourth**: The City diverted approximately 36% of residential waste in 2014. 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 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	**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.

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
			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. 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	**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.

Table 4.2 - "ALTERNATIVES TO" EVALUATION MATRIX					
Criteria	**Increased Waste Diversion**	**Landfill**	**Incineration/High Heat Processes[9]**	**Export**	**Do-Nothing**
			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 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.	**Ranked Third**: Approximately $85-$105/tonne	**Ranked Fifth**: No immediate cost but high potential long term cost as problem is not addressed.

5.0 ALTERNATIVE METHODS

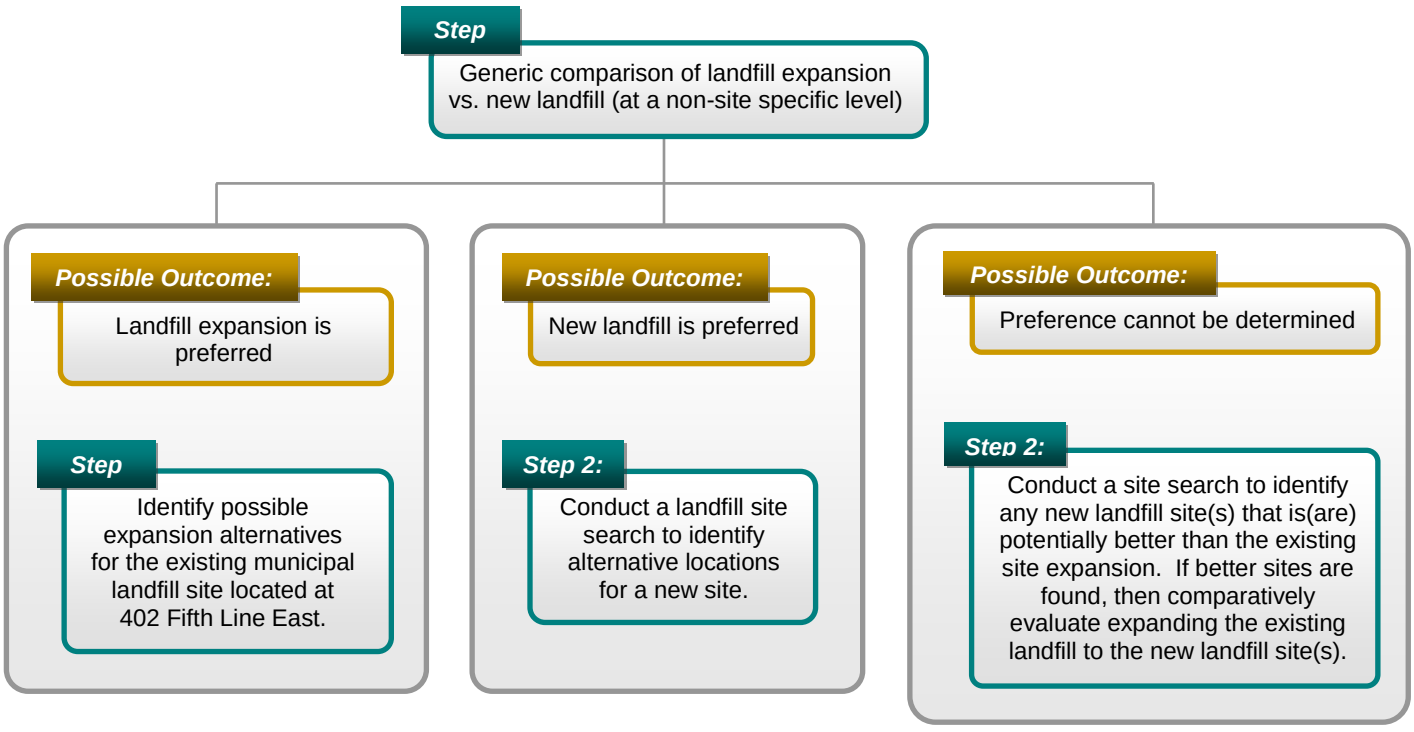
The City remains committed to investigating, implementing and supporting programs to increase waste diversion through 3Rs initiatives. Since the implementation of 3Rs initiatives does not require EA Act approval, the EA study, in this and subsequent chapters, focuses on alternative methods of landfilling residual waste. The key objective of this phase of the study was to find an environmentally suitable location and design for additional landfill capacity.

As was noted in the EA Terms of Reference, the "alternative methods" (i.e. alternative landfill locations and designs) evaluation, was carried out in two steps:

- Step 1 - Generic non-site specific comparison of a new landfill to an expansion of an existing landfill; and
- Step 2 - Identification of specific sites or expansion options based on the outcome of Step 1 and the comparison of these sites or options.

The key objective of the "alternatives methods" evaluation is to find an environmentally suitable location for the development of the additional landfill capacity that is needed. The Ontario EA Act requires the consideration of a reasonable range of alternatives. The process proposed for this study meets the above objective and the EA Act requirements. Step 1 and Step 2 are shown in the **Figure 5.1** below:

Figure 5.1
Evaluation of Alternative Methods



5.1 Step 1 – Generic Comparison of New Landfill to Existing Landfill Expansion

Step 1 in the evaluation of alternative methods for landfilling residual waste was presented for public comment in the April 2011 working paper *Solid Waste Management Environmental Assessment- Alternative Methods- Step 1 (Landfill Expansion versus Development of a New Landfill Site).*

The primary purpose of Step 1 was to provide initial focus to the search for additional landfill capacity. Undertaking this first step recognizes that a landfill siting process can create anxiety and uncertainty for residents in Sault Ste. Marie and in particular around potential sites. Reducing the number of potential siting alternatives early in the process can help to reduce this anxiety.

This step explored in a generic, non-site specific manner, whether it is preferable for Sault Ste. Marie to focus its efforts to find additional landfill capacity by expanding an existing facility or through the development of a new site. Sault Ste. Marie has one operating landfill facility that is viewed as a valuable resource. A new site could be located in either a remote area (e.g. north of the Canadian Shield line), a more developed area such as the rural area within Sault Ste. Marie or within the Sault Ste. Marie urban envelope. The conclusion of this step provides direction for Step 2 and the identification of specific sites.

The generic comparison of a new landfill site versus expanding an existing landfill site was carried out at a general level of detail in this step. Step 1 considered the different types of areas within the City where a new landfill site could be located including remote, rural, and urban areas. Specific site locations and characteristics were not considered in Step 1; they were evaluated in greater detail in Step 2.

There were three possible outcomes of this evaluation as shown in **Figure 5.1**:

- Expansion of an existing landfill is preferred;
- A new landfill is preferred; or
- Preference cannot be determined.

The generic alternatives were evaluated using the proposed criteria first presented in the EA Terms of Reference. The level of detail in the data used to assess these alternatives reflected the fact that no specific sites were considered at this time.

The following sections describe the:

- Generic alternatives that were evaluated (expansion of an existing site and development of a new landfill site);
- Criteria and indicators that were used to comparatively evaluate these two alternatives and select a preferred alternative; and
- Potential effects and differences of the two alternatives.

5.1.1 Description of Generic Alternatives

The following describes the characteristics of the two generic alternatives that were considered.

Common Characteristics of a New Site and Expanded Site

Amount of Waste and Truck Traffic: Both site alternatives would need to accommodate 2.33 million tonnes of waste to meet disposal needs to 2055. The combination of waste trucks and trucks carrying fill and/or cover material were assumed to be equal for an expansion or a new site.

Leachate Control: It was assumed that a new site or expanded site would be designed and constructed with a liner and leachate collection system. Leachate management is usually done by collecting and trucking or piping waste water to an existing municipal wastewater treatment plant; costs vary depending on the proximity of a landfill to the municipal sewer system or treatment plant.

Landfill Gas Management: It was assumed that landfill gas (LFG) collection and flaring would be required for a new or expanded landfill because the disposal volume needed is more than 1.5 million m^3 (threshold for mandatory installation of LFG control in Ontario).

Buffer Area: The buffer area is the lands between the area where the waste is placed (referred to as the waste fill area) and the edge of the landfill property. Landfill facilities such as equipment and administration buildings, drop-off areas, scales, etc., are often located within the buffer. The regulated minimum buffer width is 30 m from non-sensitive receptors and the desired minimum buffer width is 100 m from sensitive receptors.

Characteristics of a New Site

The City of Sault Ste. Marie has different types of areas in which a new landfill site could be located: remote, rural, and urban. Each area is unique with different characteristics.

It was assumed that the existing urban settlement area (i.e. within the municipal service line) as shown in the Sault Ste. Marie Official Plan, cannot likely accommodate a new landfill site due to constraints in available land, conflicting land uses, and the number of people, businesses and recreation and institutional areas. Therefore, within the context of this study, consideration was given to rural and remote areas within the City of Sault Ste. Marie. Rural areas typically are more heavily populated in comparison to remote areas and remote areas are typically characterized by relatively pristine natural areas with wildlife habitat.

Site characteristics specific to a new landfill site in Sault Ste. Marie, regardless whether located in a rural or remote area of the City include:

Site Area: The site area includes both the land required for the waste fill area and buffer area. Depending on the topography, the fill area of a new site would likely be rectangular in shape as this configuration results in a more efficient use of land compared to a square fill area. To accommodate Sault Ste. Marie's waste disposal need, a new landfill would require a minimum site area of approximately 50 ha. This is the approximate minimum area that would require property purchase and potentially displace existing features.

Facilities: Landfill facilities typically include a scale or scales, scale house, equipment and administrative building(s), public drop-off bins, internal roads, fencing, storm water management features, groundwater and landfill gas monitoring wells, leachate management features, etc. For a new landfill it was assumed that all these facilities would be constructed at the new site. Although some of the existing equipment can be relocated to a new site, there would still be a need for some equipment to stay at the old site for ongoing maintenance and monitoring.

Natural Environment: In order to accommodate the fill area and site facilities it was assumed that some natural environmental features would be displaced and/or disturbed and likely more so in a remote setting compared to a rural setting. In order to meet current design standards and effectively mitigate potential impacts to ground water resources there would be a requirement to provide leachate collection and treatment. For a new site this would take the form of trucking leachate to one of the City's waste water treatment plants or an extension to the municipal waste water collection and conveyance system. In addition the natural environmental impacts associated with the closed site would also have to be considered.

Social Environment: Although the extent of the social impacts is site dependent, there would likely be impacts to the social environment adjacent to a new site and/or along the routes used to access the new site. These impacts would involve a new group of people and would likely affect more people in a rural setting compared to a remote setting. In addition there would likely be some, albeit reduced impacts, associated with the continued maintenance and monitoring of the existing site.

Existing Landfill Site: Inherent in this alternative is the closure and post closure activities at the existing site which occur after the site no longer accepts waste. These activities would likely include:

- Final capping of all or a portion of the site;
- Installation of storm water management features;
- Monitoring groundwater and surface water quality;
- Collection and treatment of leachate;
- Landfill gas monitoring and management (i.e., collection and flaring); and

- Ongoing operation and maintenance of various monitoring systems, management systems, drainage systems and final cover.

Approximate Cost: A present value lifecycle cost analysis was completed for a new landfill capable of accommodating 2.33 million tonnes. The analysis incorporated estimated pre-development, development, operational, closure and post closure costs. Based on the analysis completed the estimated tipping fee that would have to be charged to recover all anticipated costs will range from approximately $70/tonne to $80/tonne in 2010 $'s.

Characteristics of an Expanded Site

Site characteristics specific to an expanded landfill site in Sault Ste. Marie, regardless whether located within a rural or remote area include:

Expansion Site Area: The expansion of an existing site would most likely involve a horizontal and/or vertical expansion and/or landfill mining. The expansion would likely be designed to overlap with the existing waste fill area and reasonable buffers would likely already be in place. As a result the expansion area required would most likely be less than 50 ha (the specific expansion area size would depend on the extent of overlap with the existing fill area and the suitability of existing buffers).

Facilities: Over the operating lifetime of a landfill, investment in infrastructure typically may include scale(s), scale house, administration/equipment building(s), operating equipment, public drop-off, compost pad, landfill gas collection and flaring system, leachate collection and conveyance systems, internal roads, fencing, storm water management, and a monitoring network including groundwater and gas wells and surface water monitoring stations. This infrastructure represents a significant investment. For a landfill expansion, some of this infrastructure will most likely continue to be used.

Natural Environment: In order to accommodate the fill area and site facilities required with a landfill expansion, it was assumed that some natural environmental features will be displaced and/or disturbed. Some natural environmental features have already been displaced and disturbed with the existing landfill. The area of land impacted by an expanded disposal footprint would most likely be smaller in area in comparison to a new site. In order to meet current design standards and effectively mitigate potential impacts to ground water resources there would be a requirement to provide leachate collection and treatment. For an existing site with leachate management features this would most likely take the form of an extension and/or upgrading of an existing system. There may also be an opportunity to enhance the current level of leachate management that is provided at an existing landfill.

Social Environment: Although the extent of social impacts is site dependent, the routing used to access an existing site will not change and no significant additional impacts would be expected. Furthermore there would only be a single site contributing to social

impacts whereas a new site would result in social impacts from both a closed site and a new site.

Approximate Cost: The estimated lifecycle cost for a landfill expansion is expected to be less than the lifecycle cost for a new landfill. As noted above, an expansion would likely be able to make use of some of the existing site infrastructure which would result in cost savings. An expansion also has a potential savings in approvals and property purchases. Furthermore the City would only have to monitor, maintain and report on a single site resulting in further cost savings.

5.1.2 Evaluation Criteria

The EA Terms of Reference included a list of proposed criteria for the evaluation of alternative methods. These criteria are included in **Table 5.1**. Specific indicators or ways to evaluate the alternatives under the criteria have also been presented in **Table 5.1**.

The indicators are similar for several of the criteria related to displacement and disruption. The reason is that there is only general information available to compare the alternatives when no specific sites are being considered.

The approach taken in completing the evaluation was to consider the "most probable outcome". As an example, although a new site could potentially be identified without displacing or disrupting terrestrial habitat the most probable outcome is that there will be some displacement and disruption.

Table 5.1
ALTERNATIVE METHODS EVALUATION CRITERIA – GENERIC COMPARISON

Evaluation Criteria	Indicators
Natural Environment	
Compare potential for displacement or disruption[10] of terrestrial features	• site area required • potential for disruption
Compare potential for displacement or disruption of aquatic features	• site area required • potential for disruption
Compare potential for effects on groundwater resources	• type of leachate control system • ability to meet provincial requirements
Compare potential for effects on surface water resources	• ability to meet provincial surface water protection requirements
Social-Cultural Environment	
Compare potential for displacement or disruption to residents	• site area required • potential for disruption
Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	• site area required • potential for disruption
Compare potential for impact on future land use plans	• site area required • potential for disruption

[10] Disruption includes consideration of nuisance effects.

Table 5.1 ALTERNATIVE METHODS EVALUATION CRITERIA – GENERIC COMPARISON	
Compare potential for displacement or disruption of heritage or archaeological resources	• site area required • potential for disruption
Compare potential for impacts to public health and safety (air quality, noise and dust)	• ability to meet provincial requirements
Economics	
Compare potential for displacement or disruption to existing businesses	• site area required • potential for disruption
Compare potential for displacement or disruption on agriculture/forestry/mining resources	• site area required • potential for disruption
Cost	
Compare potential lifecycle cost of alternative	• lifecycle cost analysis.
Technical Considerations	
Compare potential for providing necessary service	• ability to provide service • ease of obtaining approval and providing service
Transportation	
Compare potential for affects on airports	• ability to manage birds
Compare potential for affects on traffic volumes	• approximate number of trucks/day
Compare potential for impacts of haulage truck traffic on the movement of farm equipment	• approximate number of trucks/day

5.1.3 Potential Effects of Landfill Expansion and New Landfill Site

Table 5.2 (at the end of this section) describes the potential effects of the two alternatives, generic landfill expansion and a generic new landfill site, on the basis of the evaluation criteria and indicators.

The following summarizes the key differences between a generic new site and a landfill expansion.

Natural, Social-Cultural, Economic Environments

- **Potential for displacement –** A new landfill site generally requires more land than a landfill expansion, and therefore has greater potential for displacement of environmental and social features (assuming similar site characteristics). The degree of displacement will vary between remote and rural sites. Generally speaking, a site located in a remote area would displace more environmental features than a rural area. However, a site located in a rural area would likely affect more social features and agricultural lands.

- **Potential for disruption –** Both alternatives have similar potential to result in nuisance effects such as noise, dust, odour and truck traffic.

  A new landfill site has the potential to disrupt a new community that currently does not experience potential negative effects from a landfill. The significance of

this would depend on the character of the community in the vicinity of a new site and along the haul route. The haul route is defined as the point at which all waste vehicles converge which is usually from the closest highway intersection to the landfill site. If a new site was located in a remote area there would be fewer neighbours to disrupt but greater disruption to the natural environment and wildlife habitat.

For an existing site expansion, a degree of mutual adaptation between landfill operations and the local community occurs over the years of operating existing landfills. These adaptations include modifications to operations to reduce impacts, the establishment of communications/relationships between the operator and affected community residents/businesses, and the implementation of impact management programs. The existence of a relationship with the community in the vicinity of an existing landfill is an advantage to the operation of a site. We note that the existing Sault Ste. Marie site has operated for over 25 years and before that, the landfill was operated by a private contractor since the 1960's. Although some of the immediate neighbours at the site have expressed concerns during the operating life, the site has not resulted in significant disruption to the broader community. In addition, there is a comprehensive monitoring and impact mitigation program at the existing site to minimize environmental effects and social disruption. Through the ongoing communication between the City and area residents there has been a process of continual improvement with nuisance mitigation and the City remains committed to this initiative.

The determination of potential site and haul route disruption impacts is typically based on the number of residents and community features in the vicinity of a landfill and this information is not available for a new site. From this perspective, whether a site expansion can be expected to result in more or less disruption to a community than a new site is difficult to judge at a generic level of detail. However, a new site will require ongoing maintenance and monitoring of the closed site for a significant period of time (e.g. 50 years±) in addition to the operations at the new site. Although the level of impacts at the closed site will likely be significantly reduced, some level of impact will likely be experienced by area residents.

Cost

- **Lifecycle cost -** The comparative cost of developing and operating a landfill expansion can be expected to be less than the cost of developing and operating a new landfill.

  Site development costs for an expansion would most likely be comparatively less as it can be phased into the existing landfill infrastructure and operations. The expansion may be able to make use of some of the infrastructure associated with the existing landfill (e.g. external haul route, internal roads, existing equipment,

weigh scale(s), scale house and administrative and maintenance buildings). It could also make use of portions of existing groundwater, surface water and landfill gas monitoring systems. This represents a cost savings in site infrastructure for an expansion compared to a new site. A significant level of knowledge and understanding of site geology and hydrogeology typically exists for an existing site. Approvals costs would likely be higher for a new site because more investigation would be required compared to an existing site to bring it to a similar level of understanding for approvals. Property costs would likely be higher for a new site since more property is required.

A site expansion can likely be phased into the operation of an existing landfill, thus reducing operational costs. With many years of direct operational experience and monitoring experience at an existing site, the City can apply this site knowledge directly to the design, development and operation of an expansion, thus reducing the cost of the operational start-up period. Similarly, the government agencies that regulate the landfill have developed considerable experience in dealing with an existing site. This represents a level of regulatory experience with the existing site and its operation that could result in cost savings.

A new site would result in the addition of a new facility for which the City must develop, operate, monitor and manage. The closed site would also require ongoing maintenance, monitoring and management for a significant period of time (estimated at 50 years±). This would result in added costs compared to the site expansion.

Technical Considerations

- **Ability to provide service –** Both alternatives can provide waste management services to Sault Ste. Marie, Prince Township and Batchewana First Nation's Rankin Reserve.
- **Ease of obtaining approval and providing service –** It is anticipated that the knowledge and understanding and the level of comfort or certainty established over time with an existing landfill, would most likely result in a lower level of effort and fewer challenges to be overcome in gaining approvals in comparison to a new site.

Transportation

- **Affects on airports** – Both alternatives can most likely be managed to minimize the potential for bird impacts on airports.
- **Impacts on traffic volumes –** Both alternatives would most likely involve similar truck traffic.

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
Natural Environment			
Compare potential for displacement or disruption[1] of terrestrial features	• site area required	An expansion has the potential to result in displacement of fewer terrestrial features as less land would be required for the site.	A new landfill has the potential to result in displacement of more terrestrial features as more land would be required for the site. It is recognized that the characteristics of a new site would vary depending on its location. However it is unlikely that any new site, regardless of location would have less disruption on the natural environment than the expansion of an existing site where the lands are already part of a landfill operation.
	• potential for disruption	Both alternatives have similar potential for disruption to terrestrial features during operation. Over time some adaptation by terrestrial features has likely occurred adjacent to an existing site.	Both alternatives have similar potential for disruption to terrestrial features during operation. A new site in a remote area could potentially result in more significant disruption effects.
Compare potential for displacement or disruption of aquatic features	▪ site area required	An expansion has the potential to result in displacement of fewer aquatic features as less land would be required for the site.	A new landfill has the potential to result in displacement of more aquatic features as more land would be required for the site. It is noted that more remote sites are more likely to have pristine aquatic environments that could be displaced.
	▪ potential for disruption	Both alternatives have similar potential for disruption to aquatic features during operation.	Both alternatives have similar potential for disruption to aquatic features during operation. It is noted that more remote sites are more likely to have pristine aquatic environments that could be disrupted.

[1] Disruption includes consideration of nuisance effects.

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
Compare potential for effects on groundwater resources	• type of leachate control system	It is assumed both sites would have the same leachate control system for the new waste component.	It is assumed both sites would have the same leachate control system for the new waste component. With a new landfill both the existing closed site and the new site would have leachate controls.
	• ability to meet provincial requirements	Both alternatives must meet provincial requirements to ensure ground water protection.	Both alternatives must meet provincial requirements to ensure ground water protection. With a new landfill both the existing closed site and the new site would have to be capable of meeting provincial requirements.
Compare potential for effects on surface water resources	• ability to meet provincial surface water protection requirements	Both alternatives must meet provincial requirements to ensure surface water protection.	With a new landfill both the existing closed site and the new site must meet provincial requirements to ensure surface water protection.
Social-Cultural Environment			
Compare potential for displacement or disruption to residents	• site area required	An expansion has the potential to result in displacement of fewer residences as less new land is required.	A new landfill has the potential to result in displacement of more residences as more land would be required for the site. It is noted that locating a new landfill site in a remote area would minimize displacement impacts on residences but would increase natural environment displacement and disruption effects.
	• potential for disruption	Both alternatives have similar potential for disruption to residents around the site and along the haul route during operation. For an existing site expansion, a degree of mutual adaptation occurs between the existing hauling and landfill operations and the local community over the years of operating the landfill. The adaptations include modifications	Both alternatives have similar potential for disruption to residents around the site and along the haul route during operation. A new landfill site has the potential to disrupt a new community that currently does not experience potential negative effects from a landfill. This change could be significant depending on the character of the community in the vicinity of a

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
		to operations, the establishment of communications/ relationships between the operator and affected community, and the implementation of impact management programs.	new site and along the haul routes. It is noted that locating a new landfill site in a remote area may minimize disruption impacts on residences but would increase natural environment displacement and disruption effects.
Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	• site area required	An expansion has the potential to result in displacement of fewer community features as less new land is required.	A new landfill has the potential to result in displacement of more community features as more land would be required for the site. It is noted that locating a new landfill site in a remote area may minimize displacement impacts on community features but would increase natural environment displacement and disruption effects.
	• potential for disruption	Both alternatives have similar potential for disruption to community/recreation features during hauling and site operations. For an existing site expansion, a degree of mutual adaptation occurs between the existing hauling and landfill operations and the local community over the years of operating the landfill. The adaptations include modifications to operations, the establishment of communications/relationships between the operator and affected community, and the implementation of impact management programs.	Both alternatives have similar potential for disruption to community/recreation features during operation. A new landfill site has the potential to disrupt a new community that currently does not experience potential negative effects from a landfill. This change could be significant depending on the character of the community in the vicinity of a new site and along the haul route. It is noted that locating a new landfill site in a remote area may minimize disruption impacts on community/recreation features but would increase natural environment displacement and disruption effects.
Compare potential for impact on future land use plans	• site area required	An expansion has the potential to require change in land use designation for the expansion area but less new land is required.	A new landfill site has the potential to require change in land use designation over a larger area for the landfill.

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
	• potential for disruption	Both alternatives have similar potential for disruption to future land use plans during operation. In some instances land use plans have been developed accommodating an existing landfill.	Both alternatives have similar potential for disruption to future land use plans during operation.
Compare potential for displacement or disruption of heritage or archaeological resources	• site area required	An expansion has the potential to result in displacement of fewer archaeology or heritage features as less new land is required.	A new site has the potential to result in displacement of more archaeology or heritage features as more new land is required.
	• potential for disruption	Both alternatives have similar potential for disruption to heritage features during operation. For an existing site expansion, a degree of mutual adaptation occurs between the existing landfill operations and any local heritage features over the years of operating the landfill. The adaptations include modifications to operations, the establishment of communications/ relationships between the operator and affected community, and the implementation of impact management programs.	Both alternatives have similar potential for disruption to heritage features during operation. A new landfill site has the potential to disrupt new heritage features that currently do not experience potential negative effects from a landfill. This change could be significant depending on the character of the community in the vicinity of a new site and along the haul route.
Compare potential for impacts to public health and safety (air quality, noise and dust)	• ability to meet provincial requirements	Both alternatives must meet provincial requirements to minimize impact to air quality, noise and dust.	Both alternatives must meet provincial requirements to minimize impact to air quality, noise and dust.

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
Economics			
Compare potential for displacement or disruption to existing businesses	• site area required	An expansion has the potential to result in displacement of fewer existing businesses as less new land is required.	A new site has the potential to result in displacement of more existing businesses as more land is required. It is noted that locating a new landfill site in a remote area would likely minimize displacement of businesses but would increase natural environment displacement and disruption effects.
	• potential for disruption	Both alternatives have similar potential for disruption to businesses during hauling and site operations. For an existing site expansion, a degree of mutual adaptation occurs between the existing hauling and landfill operations and local businesses over the years of operating the landfill. The adaptations include modifications to operations, the establishment of communications/relationships between the operator and affected community, and the implementation of impact management programs.	Both alternatives have similar potential for disruption to businesses during operation. A new landfill site has the potential to disrupt new businesses that currently do not experience potential negative effects from a landfill. This change could be significant depending on the character of the businesses in the vicinity of a new site and along the haul route. It is noted that locating a new landfill site in a remote area may minimize disruption impacts on businesses but would increase natural environment displacement and disruption effects.
Compare potential impacts on agriculture/forestry/ mining resources	• site area required	An expansion has the potential to impact less agriculture/forestry/ mining resources as less new land is required.	A new site has the potential to impact more agriculture/forestry/ mining resources as more new land is required.
	• potential for disruption	Neither alternative is anticipated to have disruption impacts.	Neither alternative is anticipated to have disruption impacts.
Cost			
Compare potential lifecycle cost of alternatives	• approximate lifecycle cost of facility	The comparative cost of a landfill expansion over its life (i.e. pre-development, development, operations, closure and post closure) can be expected to be less than the cost of developing a new landfill.	The comparative cost of a new landfill site over its life (i.e. pre-development, development, operations, closure and post closure) can be expected to be more than the cost of expanding an existing landfill.

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
		The expansion will most likely be able to make use of some of the infrastructure associated with the existing landfill. It could also likely make use of portions of the groundwater, surface water and landfill gas monitoring systems. This represents a cost savings in site infrastructure for an expansion compared to a new site. An expansion also has potential savings in approvals and property purchases. The operation of the expansion can be phased into the operation of the existing landfill, thus reducing operational costs. With many years of direct operational experience at an existing site, the City can apply their high level of site knowledge directly to the design, development and operation of an expansion, thus reducing the cost of the operational start up period. Similarly, the government agencies that regulate landfills have developed considerable experience in dealing with an existing site. This level of regulatory experience could result in cost savings for an expansion. Expansion of an existing facility will limit the number of waste management facilities for which the City must monitor and manage groundwater, surface water and landfill gas.	A new site will not be able to make use of most of the infrastructure associated with an existing landfill, such as internal roads, weigh scale, and scale house, maintenance and administration buildings, and leachate and landfill gas management features. It will also require completely new groundwater, surface water and landfill gas monitoring systems. Costs may also be higher for a new site because a) more investigation would be required at a new site compared to an existing site to bring it to a similar level of understanding for approvals, and b) since more property is required for a new site, property purchase costs could be higher. A new site will not have any operational experience and knowledge, resulting in higher operational start up costs. The lack of operational experience, site monitoring experience and regulatory experience could also result in higher costs until an operating history is in place. A new site will result in the addition of a new facility for which the City must monitor and manage groundwater, surface water and landfill gas (i.e. there will continue to be ongoing maintenance and monitoring at the existing closed site). This will result in added costs compared to the site expansion.
Technical Considerations			

Table 5.2
POTENTIAL EFFECTS OF GENERIC NEW LANDFILL SITE AND LANDFILL EXPANSION
Shading indicates a clear preference; no shading indicates the alternatives were considered equal or no clear preference was identifiable

Evaluation Criteria	Indicators	Landfill Expansion	New Landfill Site
Compare potential for providing necessary service	• ability to provide service to study area	Both alternatives provide the necessary waste management service to the City.	Both alternatives provide the necessary waste management service to the City.
	• ease of obtaining approval and providing service	An expansion allows the City to make the best use of their existing knowledge of the site hydrogeology and surroundings, its infrastructure and impact management efforts. It is anticipated that the existing knowledge of an expansion site will result in a lower level of effort and fewer challenges to be overcome in gaining approvals compared to a new site.	A new site will require the City to build new infrastructure, develop impact management at another site and develop a level of knowledge of the site hydrogeology and surroundings. It is anticipated that the lack of knowledge with a new site will result in a greater level of effort and increased challenges to overcome in gaining approvals compared to existing site.
Transportation			
Compare potential for affects on airports	• ability to manage birds	Both alternatives can be managed to minimize the potential for bird impacts on airports.	Both alternatives can be managed to minimize the potential for bird impacts on airports.
Compare potential for affects on traffic volumes	• approximate number of trucks/day	Both alternatives will involve similar truck traffic.	Both alternatives will involve similar truck traffic.
Compare potential for impacts of haulage truck traffic on the movement of farm equipment	• approximate number of trucks/day	Both alternatives will involve similar truck traffic.	Both alternatives will involve similar truck traffic.

5.1.4 Step 1 Preliminary Conclusions

After evaluating both options (site expansion versus new site), a preliminary conclusion was reached that the expansion of an existing landfill is preferred over establishing a new landfill site. For several of the evaluation criteria/indicators it was not possible to establish a clear preference between the options at a generic level of detail. However, it was clear in the evaluation that an expansion is generally preferred over a new site as it would:

- Require less land and therefore displace fewer people and/or social and natural features;
- Disrupt fewer people as maintenance, mitigation and monitoring would continue at a closed site in addition to the operations at a new site if a new site was identified. Furthermore residents in the vicinity of an existing site have become accustomed to its operations and a relationship has been established between area residents and the City to focus on continual improvement of nuisance impacts;
- Cost less;
- Encounter fewer challenges in gaining technical approvals; and
- Provide opportunities for effective phasing, and minimize the number of facilities the City has to look after.

These preliminary conclusions indicate that it is preferred to initially focus resources on developing a strategy to expand an existing site subject to the results of more detailed site investigation in the next steps of the EA process.

Public review of the preliminary conclusion occurred at a workshop held on April 19, 2011. There appeared to be a general understanding and acknowledgement that there would be more challenges and costs in establishing a new site versus expanding an existing site. The principle concerns associated with an expansion of the existing site identified by area residents related to the potential for ground water quality impacts and odour management.

5.2 ALTERNATIVE METHODS – STEP 2

As discussed in Section 5.1, the Alternative Method Evaluation was divided into two steps. This chapter discusses Step 2 of the evaluation which identified and comparatively evaluated site expansion alternatives.

The site expansion alternatives and evaluation criteria were presented in the document *Solid Waste Management Environmental Assessment- Alternative Methods- Step 2 (Identification and Comparison of Expansion Options), February 2012.*

5.2.1 Evaluation Methodology and Criteria

5.2.1.1 Methodology

The following outlines the qualitative evaluation method used to comparatively evaluate the expansion options. This description, while more detailed, is consistent with the approach outlined in the EA ToR and subsequent documentation.

1. **Preparation of Options:** Expansion options were prepared based on the constraints and characteristics of the existing landfill site. The expansion options were developed in sufficient detail to allow the identification of potential effects.

2. **Collection of Data and Effects Assessment:** Data was collected and potential effects were assessed for each of the expansion options. The potential effects identified represent those effects anticipated assuming a standard level of mitigation is put in place. The effects were described using a combination of quantitative (i.e. numeric) and qualitative (i.e. descriptive) data.

   In order to assess the potential effects of the expansion options, site-specific study areas (s) have been identified as follows:

   - On-site study area- This is the land that will be required for the new on-site buffer area and fill area.
   - Off-site study area- This study area encompasses the vicinity of the site. It is based on a distance of 500 m to 1 km from the expanded fill area boundary. This distance is commonly used to assess the relative potential for impacts between options.

   The assessment of the potential effects of each of the expansion options was based on a set of criteria/indicators. The criteria and indicators are intended to ensure that the evaluation of options and the resulting identification of a preferred option consider the potential positive or negative effects of the options on all aspects of the natural, social, and economic environment as well as technical considerations, cost and transportation effects.

3. **Comparison of Options by Indicator, Criteria and Criteria Group:** Criteria groups are general categories of effects such as Natural Environment, Social Environment, Cost, etc. Criteria describe the potential effects that are identified under each of these categories and indicators describe how the effect will be measured. Using the data collected the expansion options have been ranked in order of preference for each indicator and criterion.

4. **Overall Comparison of Options:** The expansion options were comparatively evaluated based on each of the criteria groups-natural environment, social-cultural environment, economics, cost, technical and transportation.

   This comparison was completed in a two-step process. The first step involved comparing Options to identify the preferred geometry of the expansion footprint. The second step involved comparing the preliminary preferred expansion option with and without a landfill mining component.

5. **Solicitation of Public Input:** Input on the expansion options and the preliminary evaluation results was solicited through the public consultation process. The principle objective of the Step 2 Alternative Methods consultation task was to obtain feedback from the general public, agencies, Aboriginal Communities and stakeholders regarding the evaluation criteria and the preliminary results. To assist in soliciting as much input as possible, a questionnaire was developed to provide targeted feedback and a comment sheet was made available to provide general comments. The questionnaire and comment sheet were available at the March 6, 2012 Public Input Session and were posted on the project webpage on the City's website. In addition digital responses were encouraged through Survey Monkey, an online survey website.

6. **Selection of a Preferred Option:** The selection of a preferred expansion option involves considering input received through the public consultation process and identifying and making trade-offs amongst the advantages and disadvantages of the options. The option that on balance has the most advantages and least disadvantages was recommended as the preferred expansion option and carried forward for detailed effects assessment and mitigation related work.

The EA process is designed to be iterative to allow for additional options to be considered if the evaluation of the site options does not result in an environmentally sound solution or if additional information comes to light during the detailed impact assessment.

5.2.1.2 Evaluation Criteria

Table 5.4 presents the evaluation criteria used for the evaluation of alternative expansion options. These criteria were presented first in the EA Terms of Reference and were included in the Alternative Methods Step 1 Working Paper. It is noted that

some changes were made to the indicators and data sources to better reflect the options that were evaluated, they include:

- Removal of indicators related to the evaluation of impacts along the access route since all options are within the existing property boundary and will continue to use the existing entrance;
- Revision of indicators to evaluate groundwater and surface water impacts since all options are within the existing site;
- Separation of residential disruption or displacement impacts from agricultural operations since it was thought that agricultural operations are better represented in impacts to businesses and there are no significant agricultural operations in the vicinity of the site; and
- Combination of three indicators in cost criteria (estimated lifecycle cost of construction, operation and waste haulage) into one indicator (placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high).

Some of the data sources were also revised to reflect the fact that all options are within the existing site where there is sufficient background information available.

5.2.2 Description of Site Expansion Options

Expansion options were developed that make best use of the existing site characteristics and the area available to expand, and to maintain existing landfill facilities and features where possible.

Potential design constraints were considered in the development of expansion options. The site is limited in terms of footprint expansion as there is a hydro corridor along the western property boundary, Canon Creek flows along the eastern boundary and there is a large bedrock ridge along the northern boundary. Fifth Line runs east-west along the southern property boundary and a setback distance had to be maintained between the site and the adjacent sensitive features (i.e. residences).

In general, the options considered included horizontal expansion (expand the extent of the disposal footprint), vertical expansion (increase the height of the disposal footprint), landfill mining (excavate existing disposed waste and cover material, recover recyclables and earthen material or “fines” and return the waste to the disposal footprint) or a combination of these methodologies.

Based on the characteristics of the existing site, four proposed footprint expansion options were developed:

- Option 1 - West Expansion;
- Option 2 - West and North Expansion A;
- Option 3 - West and North Expansion B; and
- Option 4 - West and South Expansion.

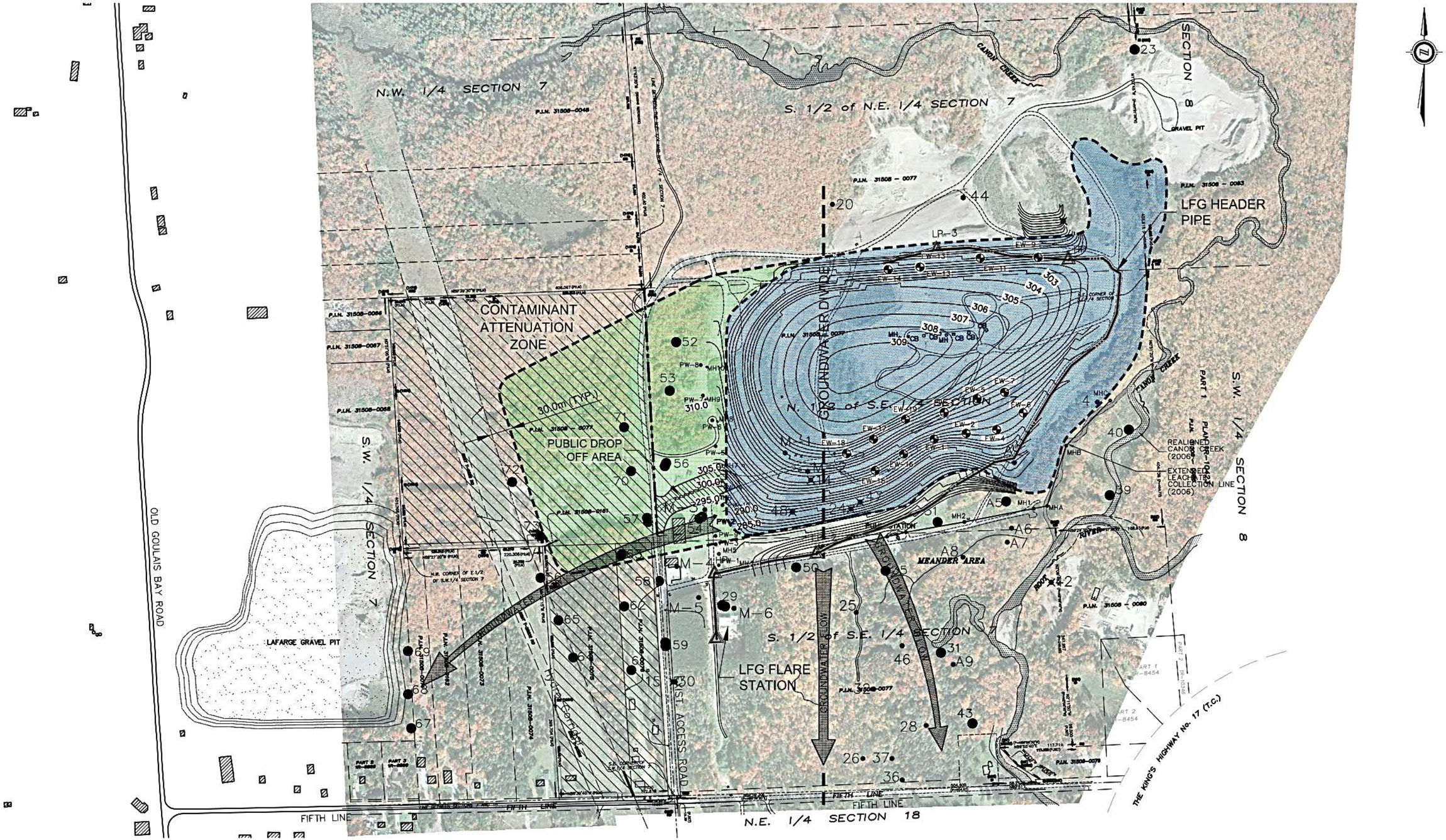
As all options relate to expanding the same site, there are commonalities between the options including:

- **Haul Route:** Vehicles would continue to enter the site from Fifth Line and any potential disruptions to residents, businesses and agricultural/mining/forestry areas along the haul route would be the same for all options.
- **Property Boundary:** All expansion options are within the existing Sault Ste. Marie owned property.
- **Setback Distance:** All expansion options have a minimum 30 metre setback distance from the property boundary.
- **Lined Landfill Base:** A liner would be installed for all new landfill cells and mined cells.
- **Slope Stability Analysis:** Side slopes of 4:1 (horizontal to vertical) and top slopes of 20:1 have been assumed for the waste fill and excavation side slopes of 3:1 have been assumed for the excavated cell. A geotechnical analysis to assess the stability of slopes for the preferred option was completed as part of the site design.
- **Quantity of Waste Disposed:** As per Section 2.0 of this document, all options were designed to manage a minimum of 2.33 million tonnes of waste. A landfill capacity of approximately 4.2 million m³ is required to landfill this quantity of waste based on historic waste densities. (The capacity is calculated as 2.33 million tonnes / 0.56 tonnes/m^3 = 4.2 million m^3.) Increased waste densities may be achieved through equipment and manpower enhancements.

The following sections provide a description of each proposed footprint expansion option.

5.2.2.1 Option 1 – West Expansion

Option 1 – West Expansion involves the expansion of the current site from the Western edge towards the hydro corridor (**Figure 5.2**). The height of the expansion would be moderately higher than the existing landfill mass (approximately 2 metres higher) and the average depth of expansion would be 18 metres.



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Sault Ste. Marie Municipal Landfill Site

OPTION 1
WEST EXPANSION

Proj. Manager: KK		Drawn By: SKB	Figure No. 5.2
Scale: 1 : 6000		Checked By: FRG	
Date Issued: NOV. 2011		Project No: 06-6988	
Location: G:\CAD\066988		File Name: Option-1.dwg	

Expansion to the west would require relocation of several facilities; the public drop off area, inbound and outbound scales, scale house and maintenance building. The existing administration building could likely be maintained in its current location. **Table 5.3** summarizes the site features and infrastructure that may require relocation or removal as a result of this option.

The estimated disposal capacity with Option 1 is 3.2 million m³ (i.e. 1.79 million tonnes) assuming that current waste densities are achieved. To achieve the required capacity (4.2 million m³), this alternative includes a 30% increase in the in-situ density; i.e. 910 kg/m³ in-situ waste density (728 kg/m³ apparent density). It is expected that this density may be challenging to achieve and greater operational controls may be required such as the purchase of specialized compacting equipment.

The soil generated by the base excavation is expected to supply soil for cover needs (i.e. 1,280,000 m³ (soil available) - 935, 000 m³ (daily, interim and final cover needs) is 345,000 m³ surplus).

5.2.2.2 Option 2 – West and North Expansion A

Option 2 – West and North Expansion A would expand to the western and northern limits of the existing landfill (**Figure 5.3**). This option also includes a vertical expansion of 4 m from the existing site and an average depth of the west expansion area of 18 m. At other sites that have been vertically expanded, a liner system has been placed on existing waste to reduce the impacts of expanding vertically on unlined areas (e.g., Ottawa Trail Road Landfill). Lining of the existing waste before vertical expansion of the fill area could be included for this option. However, the amount of proposed vertical expansion is relatively modest in comparison to other sites where the vertical expansion has been more significant. For the purposes of the evaluation a liner over the existing waste has been included.

N.W. 1/4 SECTION 7

S. 1/2 of N.E. 1/4 SECTION 7

S.W. 1/4 SECTION 8

GRAVEL PIT

CANOE CREEK

LFG HEADER PIPE

CONTAMINANT ATTENUATION ZONE

GROUNDWATER DIVIDE

N. 1/2 of S.E. 1/4 SECTION 7

S. 1/2 of S.E. 1/4 SECTION 7

LFG FLARE STATION

MEANDER AREA

REALIGNED CANOE CREEK (2006)

EXTENDED LEACHATE COLLECTION LINE (2006)

PART 1 PLAN 1R-10423

PART 1 PLAN 1R-8454

PART 2 PLAN 1R-8454

WATER TABLE CONTOUR (TYP.)

30.0m (TYP.)

OLD GOULAIS BAY ROAD

LAFARGE GRAVEL PIT

FIVE MILE CREEK

FIVE MILE CREEK DIVERSION

EAST ACCESS ROAD

FIFTH LINE

THE KING'S HIGHWAY No. 17 (T.C.)

N.E. 1/4 SECTION 18

P.I.N. 31508-0048

P.I.N. 31508-0077

P.I.N. 31508-0053

P.I.N. 31508-0080

P.I.N. 31508-0079

P.I.N. 31508-0067

P.I.N. 31508-0068

P.I.N. 31508-0073

P.I.N. 31508-0074

P.I.N. 31508-0076

Legend:

- 24 — MONITORING WELL THAT NO LONGER EXISTS
- 52 — MONITORING WELL NOT SAMPLED IN 2007
- PW 3 — PUMPING WELL
- MH 3 — LEACHATE COLLECTION SYSTEM
- PROPERTY BOUNDARY
- LIMIT OF FILL
- 40 — MONITORING WELL SAMPLED IN 2007
- M-1 — METHANE GAS MONITOR
- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BULDING\RESIDENCE
- LFG EXTRACTION WELL
- SURFACE WATER CONTROL DITCH
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL

0 100 200
SCALE IN METRES

DILLON CONSULTING

Sault Ste. Marie Municipal Landfill Site

OPTION 2
WEST AND NORTH EXPANSION A

Proj. Manager: KK		Drawn By: SKB	Figure No. 5.3
Scale:	1 : 6000	Checked By: FRG	
Date Issued:	NOV. 2011	Project No: 06-6988	
Location:	G:\CAD\066988	File Name: OPTION-3.dwg	

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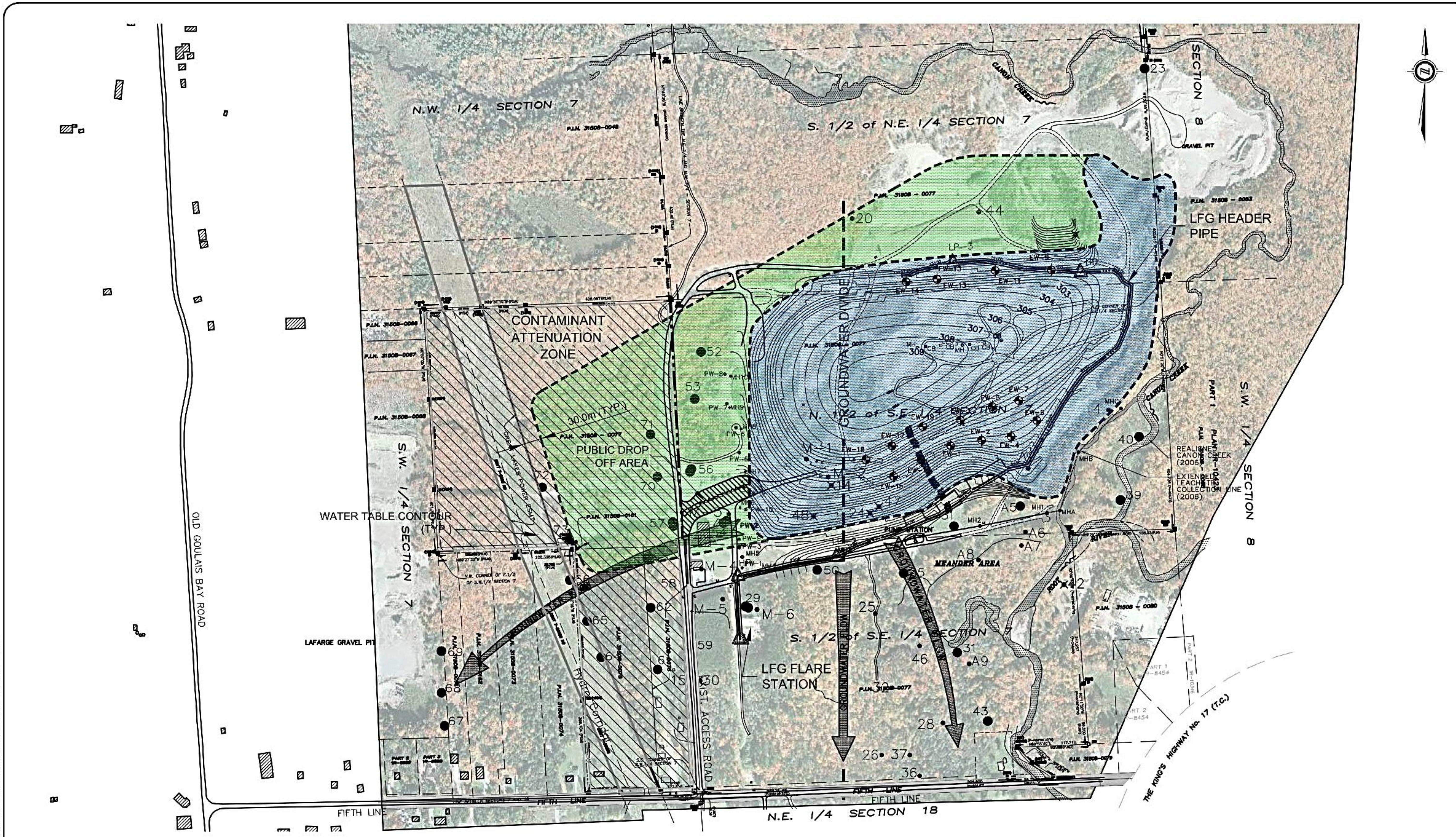
By including a northerly expansion, this alternative preserves the public drop-off area, inbound and outbound weigh scales, scale house and maintenance building. **Table 5.3** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

The estimated disposal capacity is 4.2 million m³ (i.e. 2.32 million tonnes) assuming that current waste densities are achieved. This option provides the target disposal capacity at current compaction rates reported at the existing landfill, i.e. in-situ waste density of 700 kg/m³ or apparent density of 560 kg/m³. It is expected that this density can be achieved without greater operational controls.

The soil generated by the base excavation is expected to supply soil for cover needs (i.e. 1,687,000 m³ (soil available) - 1,259,000 m³ (daily, interim and final cover needs) is 428,000 m³ surplus).

5.2.2.3 Option 3 – West and North Expansion B

Option 3 – West and North Expansion B is a combination of Options 1 and 2 which includes the expansion of the landfill from the western edge of the existing site towards the hydro corridor and a northern expansion from the northern limit of the existing landfill (**Figure 5.4**). This option also includes a vertical expansion of 4 m from the existing site. At other sites that have been vertically expanded, the placement of a liner system on top of existing waste has been completed to reduce the impacts of expanding vertically on unlined areas (e.g., Ottawa Trail Road Landfill). Lining of the existing waste before vertically extending the fill area could also be included for this option. However, the amount of vertical expansion (4 m) is relatively modest in comparison to other sites where the vertical expansion has been more significant. For the purposes of the evaluation a liner over the existing waste has been included.



Legend:

- ×24 MONITORING WELL THAT NO LONGER EXISTS
- •52 MONITORING WELL NOT SAMPLED IN 2007
- PW 3 PUMPING WELL
- MH 3 LEACHATE COLLECTION SYSTEM
- PROPERTY BOUNDARY
- LIMIT OF FILL
- ●40 MONITORING WELL SAMPLED IN 2007
- •M−1 METHANE GAS MONITOR
- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BUILDING\RESIDENCE
- LFG EXTRACTION WELL
- SURFACE WATER CONTROL DITCH
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL

0 100 200
SCALE IN METRES

DILLON CONSULTING

Sault Ste. Marie Municipal Landfill Site

OPTION 3
WEST AND NORTH EXPANSION B

Proj. Manager:	KK	Drawn By:	SKB	Figure No.
Scale:	1 : 6000	Checked By:	FRG	5.4
Date Issued:	NOV. 2011	Project No:	06-6988	
Location:	G:\CAD\066988	File Name:	OPTION-3.dwg	

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The average depth of the west expansion is 11 metres and is 7 metres shallower than the other options. This is possible due to the increase in surface area available for this expansion option.

Expansion to the west would require the relocation of the public drop off area, inbound and outbound scales, scale house and maintenance building. **Table 5.3** presents a summary of the site features and infrastructure that may require relocation or removal if this option were selected.

The estimated disposal capacity for Option 3 is 4.2 million m³ (i.e. 2.32 million tonnes) assuming that current waste densities are achieved. This option achieves the target disposal capacity at the existing landfills current compaction rates. It is anticipated that this density can be achieved without greater operational controls.

The soil surplus generated by the base excavation is expected to supply soil for cover needs (i.e. 1,687,000 m³ (soil available) - 1,328, 000 m³ (daily, interim and final cover needs) is 359,000 m³ surplus).

5.2.2.4 Option 4 – West and South Expansion

Option 4 - West and South Expansion involves two separate landforms for the expansion (**Figure 5.5**). The first is an expansion west from the existing western limit of the site and the second is south of the southern limit of the existing site. The height of the expansion site would be the same height as the existing site and the average depth of the expansion is 18 m. Expansion to the south and west would require relocation of the Household Hazardous Waste facility (former Elementa facility) and blower station. **Table 5.3** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

N.W. 1/4 SECTION 7

S. 1/2 of N.E. 1/4 SECTION 7

S.W. 1/4 SECTION 7

S.W. 1/4 SECTION 8

N. 1/2 of S.E. 1/4 SECTION 7

S. 1/2 of S.E. 1/4 SECTION 7

N.E. 1/4 SECTION 18

CONTAMINANT ATTENUATION ZONE

PUBLIC DROP OFF AREA

GROUNDWATER DIVIDE

MEANDER AREA

EAST ACCESS ROAD

OLD GOULAIS BAY ROAD

FIFTH LINE

THE KING'S HIGHWAY No. 17 (T.C.)

CANOE CREEK

REALIGNED CANOE CREEK (2006)

EXTENDED LEACHATE COLLECTION LINE (2006)

LAFARGE GRAVEL PIT

GRAVEL PIT

RIVER

P.I.N. 31508-0048

P.I.N. 31508-0077

P.I.N. 31508-0083

P.I.N. 31508-0080

P.I.N. 31508-0079

P.I.N. 31508-0074

P.I.N. 31508-0073

P.I.N. 31508-0072

P.I.N. 31508-0067

P.I.N. 31508-0066

100.0

0 100 200

SCALE IN METRES

DILLON CONSULTING

Legend:

- ✕24 MONITORING WELL THAT NO LONGER EXISTS
- ●52 MONITORING WELL NOT SAMPLED IN 2007
- PW 3 PUMPING WELL
- MH 3 LEACHATE COLLECTION SYSTEM
- PROPERTY BOUNDARY
- LIMIT OF FILL
- ●40 MONITORING WELL SAMPLED IN 2007
- ●M-1 METHANE GAS MONITOR
- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BULDING\RESIDENCE
- LFG EXTRACTION WELL
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL

Sault Ste. Marie Municipal Landfill Site

OPTION 4
WEST AND SOUTH EXPANSION

Proj. Manager: KK	Drawn By: SKB	Figure No.
Scale: 1 : 6000	Checked By: FRG	5.5
Date Issued: NOV. 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: Option-5.dwg	

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In addition to the 30 metre setback from the hydro corridor, there is also a 100 metre setback from Fifth Line. Creating separate landforms requires larger footprints since a separate landform cannot build on an existing side slope.

The estimated disposal capacity is similar to Option 1, 3.2 million m^3 (i.e. 1.79 million tonnes) assuming that current waste densities are achieved. The in-situ density would have to be increased by 30% to achieve the target disposal capacity, i.e 910 kg/m^3 in-situ waste density (728 kg/m^3 apparent density). It is expected that this density may be challenging to achieve and greater operational controls may be required such as the purchase of specialized compacting equipment.

The soil surplus generated by the base excavation is expected to supply soil for cover needs.

Table 5.3
SUMMARY OF INFRASTRUCTURE CHANGES FOR GEOMETRIC EXPANSION OPTIONS

Infrastructure Element	Relocation or Reconstruction Required (Y or N)			
	Option 1	Option 2	Option 3	Option 4
Public access road	N	N	N	N
Inbound and outbound weigh scales	Y	N	Y	N
Scale house	Y	N	Y	N
Public waste drop-off	Y	N	Y	N
Administration building	N	N	N	N
Maintenance garage	Y	N	Y	N
Internal access roads throughout the disposal area	Y	Y	Y	Y
Wood waste drop-off area	Y	Y	Y	Y
Compost processing area	N	Y	Y	N
Tire drop-off area	Y	Y	Y	Y
Shingles, construction and demolition materials drop-off bunker	Y	Y	Y	Y
Batteries and propane tank drop-off area	Y	Y	Y	Y
Recyclables drop-off area	Y	Y	Y	Y
Purge wells (adjacent to the western boundary of the disposal footprint);	Y	Y	Y	N
Gravity leachate collection system (adjacent to the southern and south-eastern boundary of the disposal footprint);	N	N	N	N
Groundwater monitoring wells	Some	Some	Some	Some
Active landfill gas wells and associated piping network (constructed in 2010)	N	N	N	N
Blower station and central flare for the active landfill gas system (constructed in 2010)	N	N	N	Y
Leachate pump station	N	N	N	N
Storm water management pond	N	Y	Y	N
Household Hazardous Waste facility (formerly Elementa)	N	N	N	Y

5.2.3 Description of Environmental Conditions and Comparative Evaluation of Options

Data was collected by the project team on the basis of the criteria and indicators for each of the four proposed site expansion alternatives. **Table 5.5** (at the end of this report section) provides the data collected and preference ranking for each of the criteria and indicators used in the evaluation of the geometric expansion options. The site expansion options are ranked from most preferred (rank of 1) to least preferred (rank of 4). The ranking is based on a comparative assessment of the net effects of the site expansion alternatives. The net effects refer to the potential for effects assuming standard mitigation measures are implemented.

The following sections present the information collected for each of the expansion alternatives describing the key differences between the expansion options based on each of the criteria groups: Natural Environment, Socio-Cultural Environment, Economics, Cost, Technical Considerations, and Transportation.

Table 5.4
ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA

Criteria Group/Criteria	Indicators	Data Sources
Natural Environment[11]		
• Compare potential for displacement or disruption of terrestrial features	• Area and significance of terrestrial features on site that would be displaced.	• Aerial photos • Field assessment
	• Area and significance of terrestrial features off-site that may experience disruption effects during operation.	• Aerial photos • Field assessment
• Compare potential for displacement or disruption of aquatic features	• Amount and significance of aquatic habitat on-site that would be displaced or disrupted	• Aerial photos • Field assessment
	• Amount and significance of aquatic habitat off-site that may be disrupted during operation	• MNR mapping/fisheries data • Aerial photos
• Compare potential for effects on groundwater resources	• Effect on management of existing site impacts	• Discussion with City Staff
	• Groundwater monitoring requirements	• Groundwater mapping • Topographic mapping
	• Contingency options for new fill area	• Conceptual site design
• Compare potential for effects on surface water resources	• Effect on management of existing site impacts	• Discussion with City Staff
	• Surface water monitoring requirements	• Surface water mapping • Topographic mapping • Field assessment
	• Contingency options for new fill area	• Conceptual site design
Social-Cultural Environment		
• Compare potential for displacement or disruption to residents[12]	• Number of residences on-site who would be displaced.	• Topographic and aerial mapping • Site review
	• Number of residences off-site who may experience	• Topographic and aerial mapping

[11] In the EA Terms of Reference, the Natural Environment Criteria Group included the criterion "Compare potential for impacts related to air quality, noise and dust" within the Natural Environment Criteria Group. Noise has been considered under the criterion "Compare potential for displacement or disruption to residents" and Air Quality has been considered under the criterion "Compare potential for impacts to public health and safety".
[12] In the EA Terms of Reference, this criterion included reference to agriculture. All alternatives are on-site and thus there will be no impact to agricultural operations so this reference was removed from the criterion.

Table 5.4
ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA

Criteria Group/Criteria	Indicators	Data Sources
	disruption effects (e.g. noise, dust, odour) during operation.	• Site review
	• Character of the community in the vicinity of the site and potential for impact on that character	• City input • Land use mapping • Site review
• Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	• Number and type of community features on-site that would be displaced.	• Topographic and aerial mapping • Site review
	• Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.	• Topographic and aerial mapping • Land use mapping • Site review
• Compare potential for impact on future land use plans	• Area and designation of land to be displaced on-site	• Official plan(s) • Zoning by-laws • City planning staff contact
	• Area and designation of land to be disrupted off-site	• Official plan(s) • Zoning by-laws • City planning staff contact
	• Change in land use character compared to existing designations	• Official plan • Zoning by-laws • City planning staff contact
• Compare potential for displacement or disruption of heritage or archaeological resources	• Presence of known archaeological resources on-site	• Ministry of Culture • City staff
	• Number of built heritage or cultural landscape features on-site that would be displaced	• Historical records • City staff
	• Number of built heritage or cultural landscape features off-site that might be disrupted	• Historical records • City staff
• Compare potential for impacts to public health and safety (air quality)	• Ability to meet provincial regulations	• MOECC regulations
Economics		
• Compare potential for displacement or disruption to existing businesses	• Number, type and sensitivity of businesses on-site that would be displaced.	• Topographic and aerial mapping • Site review

Table 5.4
ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA

Criteria Group/Criteria	Indicators	Data Sources
	• Number, type and sensitivity of businesses off-site that might experience disruption effects during operation	• Topographic and aerial mapping • Site review
• Compare potential for displacement or disruption on agriculture/forestry/mining resources	• Area of on-site agriculture/forestry or mining industry resources that would be displaced	• Topographic and aerial mapping • MNR mapping • Site review
	• Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation	• Topographic and aerial mapping • MNR mapping • Site review
Cost		
• Compare potential lifecycle cost of alternative	• Placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high)	• Conceptual site designs • Historical operating costs
Technical Considerations		
• Compare ease of implementation[13]	• Ease of site development and operation	• Waste density • Conceptual site design
	• Effects on existing/proposed landfill infrastructure	• Conceptual site design
Transportation		
• Compare potential for affects on airports	• Distance from Sault Ste. Marie airport	• Topographic mapping
• Compare potential for affects on traffic volumes	• Annual truck kilometres travelled and character of roadway (i.e. single lane one direction, multi-lane)	• Estimated numbers of trucks • Topographic mapping
	• Annual number of trucks travelling through intersections	• Road maps • Estimated numbers of trucks
• Compare potential for impacts of haulage truck traffic on the movement of farm equipment	• Annual number of trucks travelling through agricultural areas	• Road maps • Estimated numbers of trucks

[13] The wording of this criterion was revised from that included in the EA Terms of Reference for clarity purposes.

Natural Environment

The Natural Environment Criteria Group includes four criteria to evaluate the potential for displacement or disruption to terrestrial features and aquatic features, as well as effects on groundwater and surface water resources. The following describes the difference between the options for each criterion. The overall ranking of the options from a natural environment perspective is shown in **Table 5.6**.

Compare potential for displacement or disruption of terrestrial features - For terrestrial features, all options require a footprint expansion and therefore a resulting displacement of on-site forested area. Option 4 requires the largest amount of on-site forest displacement at 16.1 ha. Options 1, 2, and 3 all displace less than half that amount (6.9 ha, 7.1 ha, and 7.7 ha respectively). Further, Option 4 encroaches on a wetland feature. All options have the same potential for disruption off-site.

Compare potential for displacement or disruption of aquatic features - Aquatic features on-site include Canon Creek and Root River. Options 1, 2, and 3 are not expected to change the impact to these features nor any aquatic habitat downstream. The west and south expansion, Option 4, has the greatest potential for disruption to aquatic habitat on-site and downstream since it overlaps a tributary of Root River.

Compare potential for effects on groundwater resources - To assess site impacts to groundwater, potential impact management options, monitoring requirements, and contingency needs were assessed. In terms of impact management, Options 1, 2, and 3 allow the construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. However, of these options only Options 2 and 3 allow vertical expansion with liner on top of existing fill. This may reduce the possibility of increasing existing fill impacts to groundwater resources. Option 4 provides less opportunity to create a horizontal collector in the west, but allows for continued use of existing northern purge wells. From the perspective of monitoring and contingency, Option 4 creates three distinct fill areas which increases monitoring requirements and impacts contingency measures. All other options result in a singular site for monitoring as well as a singular approach to contingency options.

Compare potential for effects on surface water resources - Impact management options, monitoring requirements, and contingency needs were assessed for effects on surface water resources. Option 1 would not affect mitigation or monitoring, and has a reduced potential need for contingency measures since there are no surface water features in the vicinity of the western expansion. Options 2 and 3 also do not affect present mitigation measures, but both may require a small change in surface water monitoring requirements due to expansion to the north. The northern expansion in Options 2 and 3 also requires consideration of contingency measures for Canon Creek. Due to the southern expansion portion of Option 4, surface water monitoring requirements will increase, and contingency measures for the former meander area (i.e. Root River) will be required.

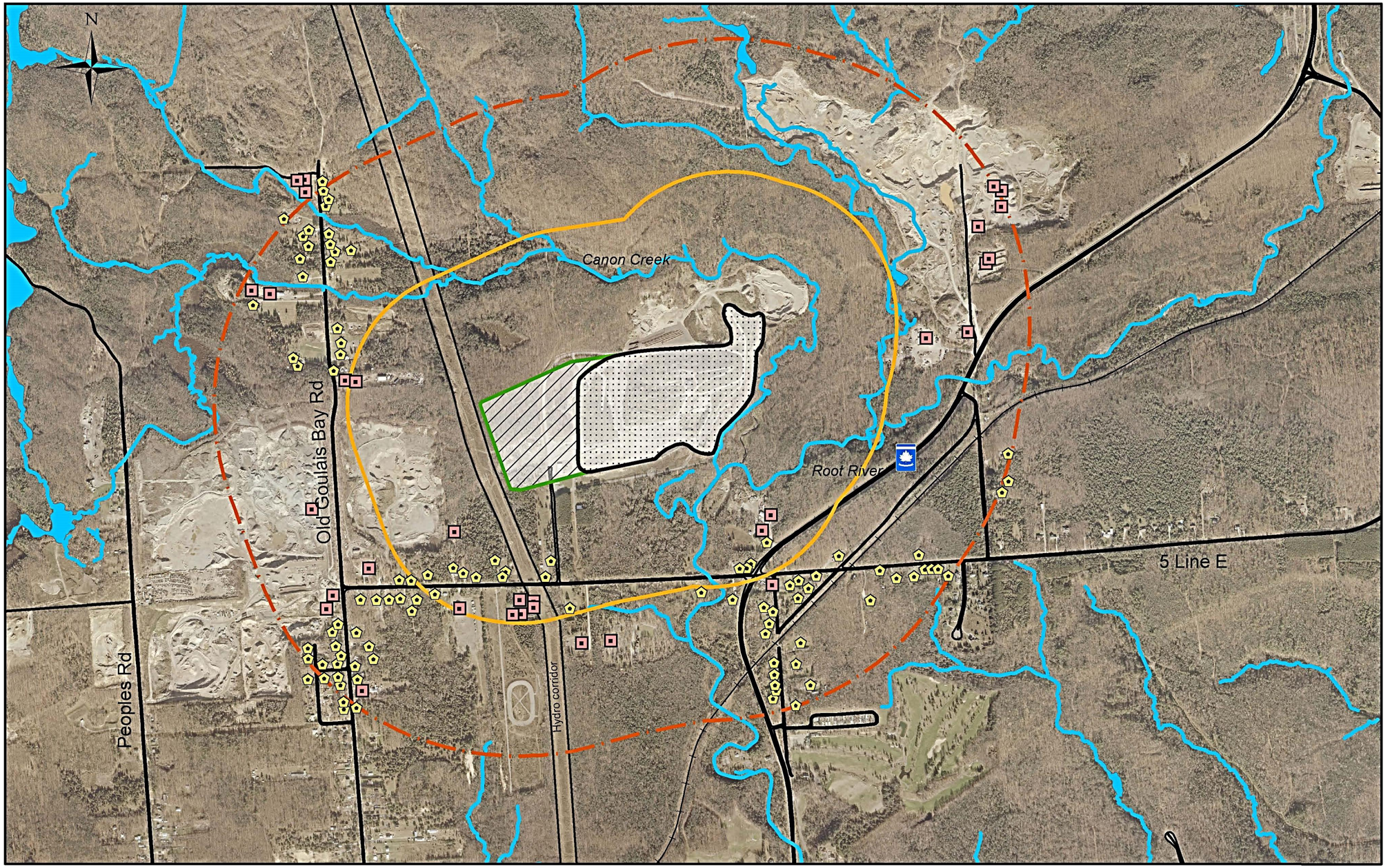
Overall Natural Environment Ranking – Option 4 was considered least preferred for all natural environment criteria. The differences between Options 1, 2 and 3 related to ground and surface water resources. Impact to groundwater resources was considered to be harder to mitigate than surface water impacts. Thus Options 2 and 3 were considered preferred over Option 1.

Table 5.6
NATURAL ENVIRONMENT CRITERIA GROUP RANKING SUMMARY

Criteria	Option 1 – West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Compare potential for displacement or disruption of terrestrial features	First	First	First	Second
Compare potential for displacement or disruption of aquatic features	First	First	First	Second
Compare potential for effects on groundwater resources	Second	First	First	Third
Compare potential for effects on surface water resources	First	Second	Second	Third
Natural Environment Ranking	Second	First	First	Third

Social-Cultural Environment

The Social-Cultural Environment Criteria Group includes five criteria to evaluate the potential for displacement or disruption to residents, community features, heritage or archaeological resources, as well as potential impacts to future land use plans, and public health and safety. The following describes the difference between the options for each criterion. The mapping completed as a part of this evaluation is found in **Figures 5.6 to 5.9**. The figures show residences and businesses within the study area for each of the proposed expansion Options. The overall ranking of the options from a social-cultural perspective is shown in **Table 5.7**.



0 125 250 500 750 1,000
Meters

DILLON CONSULTING

Legend

- TRANS-CANADA HIGHWAY
- ROADS
- RAILWAY
- WATER BODY
- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- 1000 m STUDY AREA
- 500 m STUDY AREA

BUILDINGS
- Industry
- Residence
- School

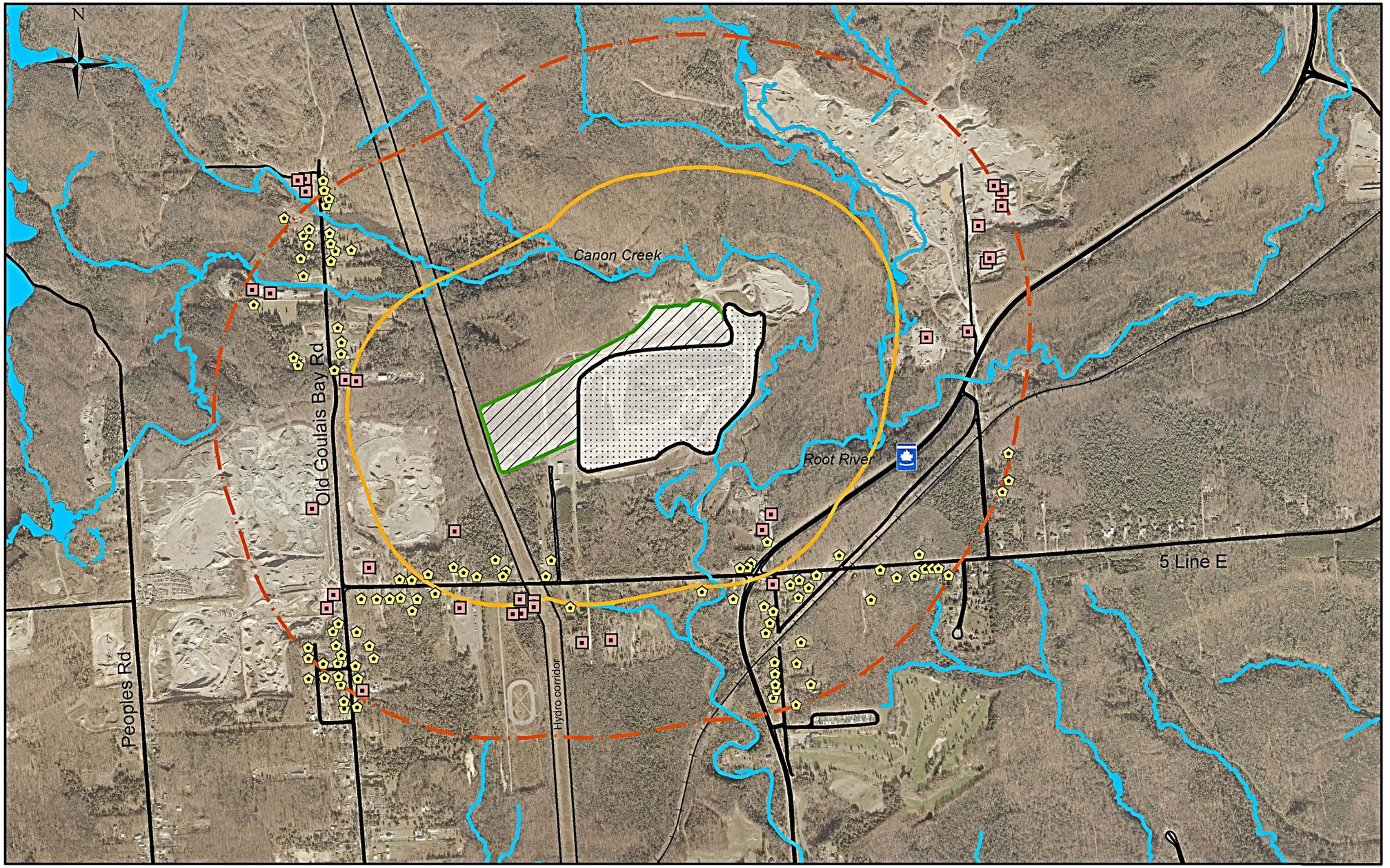
Sault Ste. Marie Municipal Landfill Site

OPTION 1
WEST EXPANSION

Project Manager:	KK	Drawn By:	SLP
Scale:	1 : 20 000	Checked By:	BV
Date Issued:	FEB 2012	Project No:	06-6988
Location:	G:\GIS\066988	File Name:	SSM Option 1 - 2012

Figure No.

5.6



0 125 250 500 750 1,000 Meters

DILLON CONSULTING

Legend

- TRANS-CANADA HIGHWAY
- ROADS
- RAILWAY
- WATER BODY
- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- 1000 m STUDY AREA
- 500 m STUDY AREA

BUILDINGS

- Industry
- Residence
- School

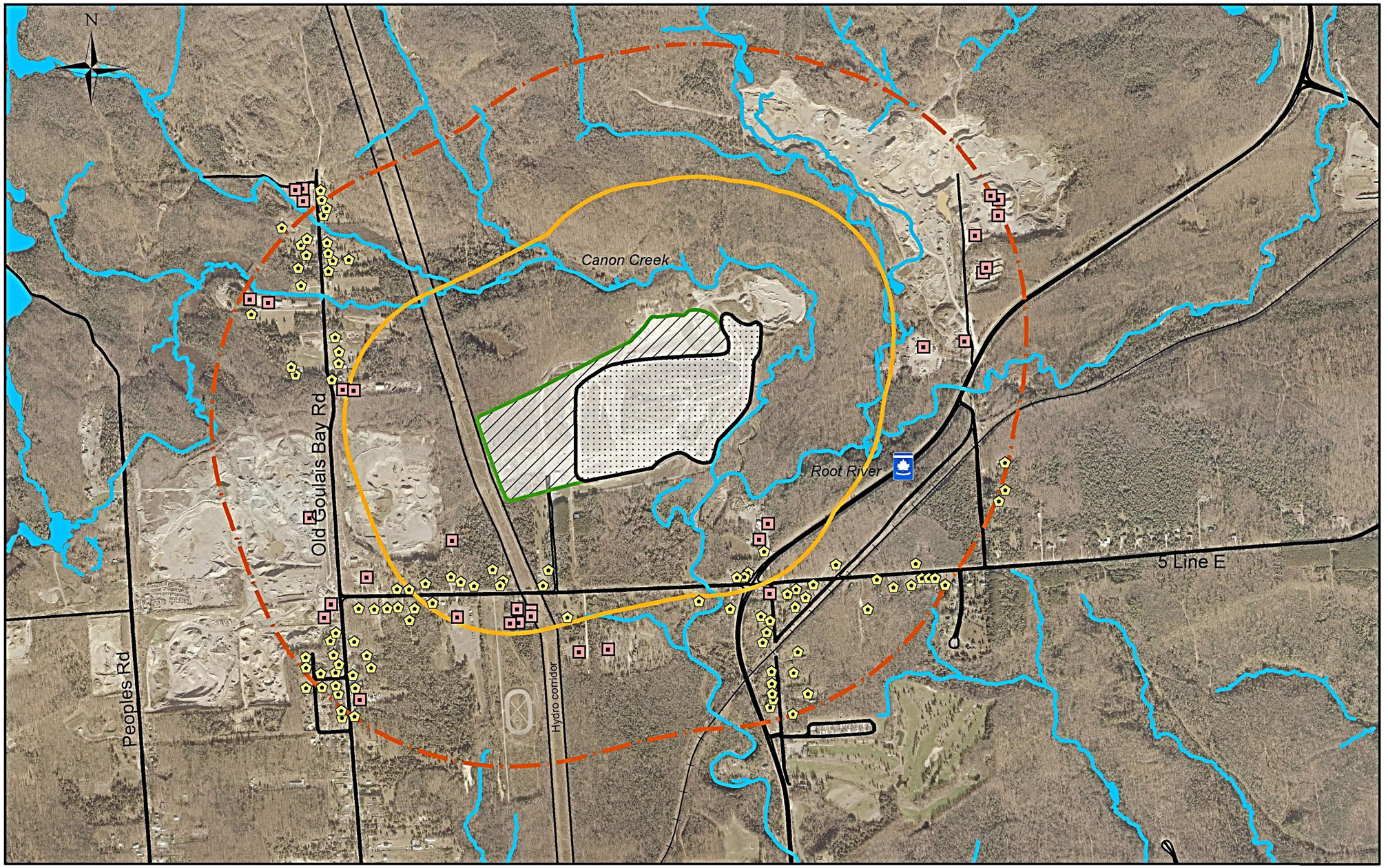
Sault Ste. Marie Municipal Landfill Site

OPTION 2
WEST AND NORTH EXPANSION A

Project Manager:	KK	Drawn By:	SLP
Scale:	1 : 20 000	Checked By:	BV
Date Issued:	FEB 2012	Project No:	06-6988
Location:	G:\GIS\066988	File Name:	SSM Option 2 - 2012

Figure No.

5.7



0 125 250 500 750 1,000
Meters

Legend

- TRANS-CANADA HIGHWAY
- ROADS
- RAILWAY
- WATER BODY
- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- 1000 m STUDY AREA
- 500 m STUDY AREA

BUILDINGS
- Industry
- Residence
- School

DILLON CONSULTING

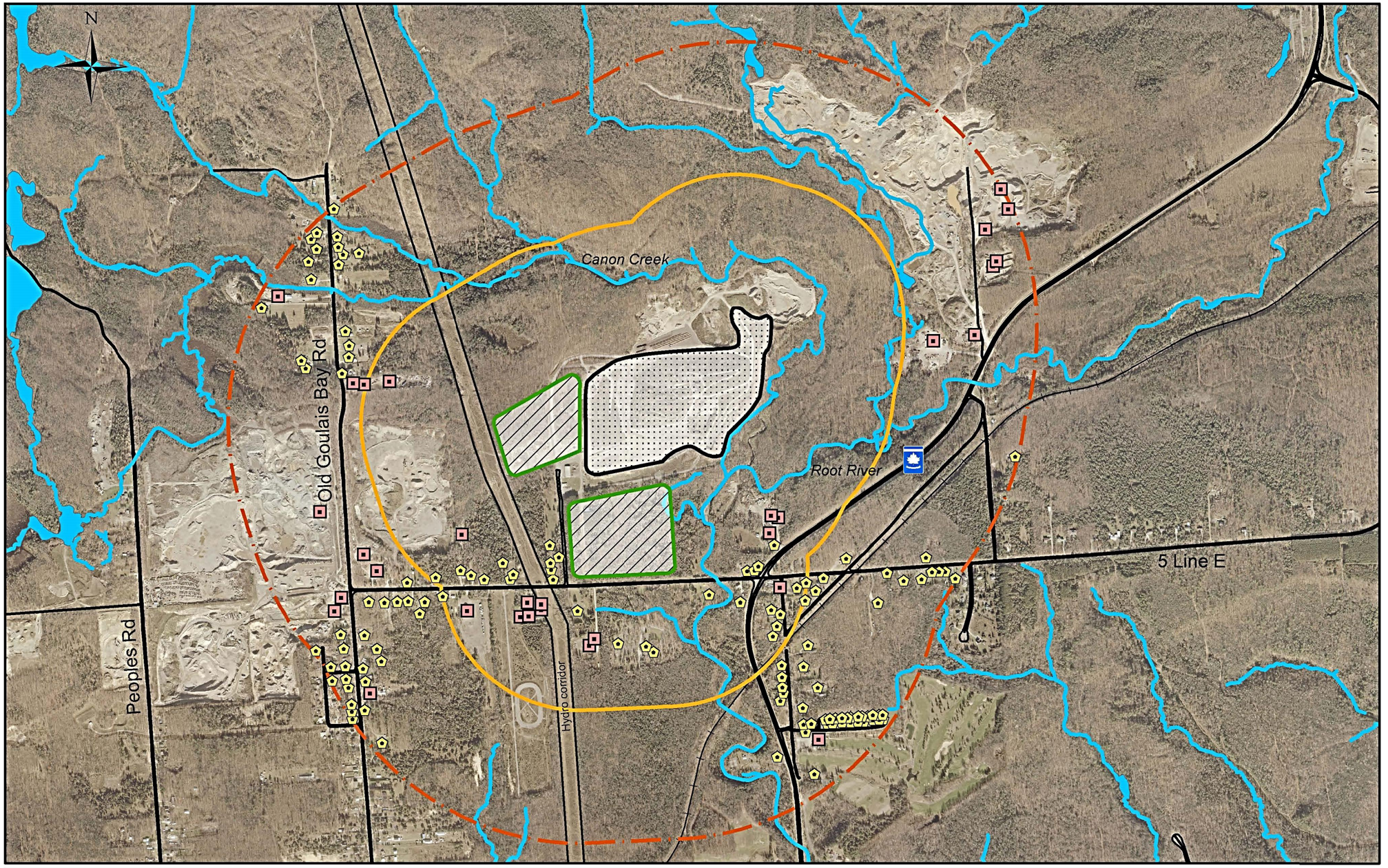
Sault Ste. Marie Municipal Landfill Site

OPTION 3
WEST AND NORTH EXPANSION B

Project Manager: KK
Scale: 1 : 20 000
Date Issued: FEB 2012
Location: G:\GIS\066988

Drawn By: SLP
Checked By: BV
Project No: 06-6988
File Name: SSM OPTION 3 - 2012

Figure No.
5.8



0 125 250 500 750 1,000 Meters

DILLON CONSULTING

Legend

- TRANS-CANADA HIGHWAY
- ROADS
- RAILWAY
- WATER BODY
- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- 1000 m STUDY AREA
- 500 m STUDY AREA

BUILDINGS
- Industry
- Residence
- School

Sault Ste. Marie Municipal Landfill Site

OPTION 4
WEST AND SOUTH EXPANSION

Project Manager:	KK	Drawn By:	SLP
Scale:	1 : 20 000	Checked By:	BV
Date Issued:	FEB 2012	Project No:	06-6988
Location:	G:\GIS\066988	File Name:	SSM Option 4 - 2012

Figure No.

5.9

Compare potential for displacement or disruption to residents – To evaluate impacts on residents, this criteria examines the number of residential displacements, number of residents in the off-site study area, and the potential for impact to community character. All four options involve an expansion within the existing property boundary and therefore result in no residential displacement. All four options also have the same potential to impact the character of the community within the vicinity of the site. While all four options have around the same number of residences within the 1 km off-site study area, (approximately 97 residences), Option 4 has an increased potential for disruption and visual impact since it is closest to residences by its southern extension.

Compare potential for displacement or disruption to community features; Compare potential for displacement or disruption of heritage or archaeological resources; Compare potential for impacts to public health and safety – For these three criteria, all four Options have equal potential for impact on community features, heritage or archaeological resources, and public health and safety. There are no anticipated impacts to community features since all options are within the existing property boundary and there are no community features within 1 km. Similarly, there are no known archeological resources on-site and no built heritage or cultural landscape features within 1 km of the off-site study area. Since all options are designed to meet provincial regulations for air quality, there is limited potential for impacts to health and safety.

Compare potential for impact on future land use plans – When considering the impact to future land uses, all options also have similar affects. As mentioned, the expansion options all sit within the existing property boundary and fall within the same land use designation (i.e. rural area), thus a change in land use character is not anticipated. Option 4 is less preferred as it is closest to an area with an Environmental Management designation (i.e. Root River). An amendment to the zoning by-law would be required for all options.

Overall Social-Cultural Ranking – With two exceptions, the Options were ranked equally across all five social-cultural criteria. In two cases, for residential displacement or disruption and potential impact on future land use plans, Option 4 was less preferred than Options 1, 2, and 3. Therefore, Options 1, 2, and 3 were preferred over Option 4.

Table 5.7
SOCIAL-CULTURAL CRITERIA GROUP RANKING SUMMARY

Criteria	Option 1 – West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Compare potential for displacement or disruption to residents	First	First	First	Second
Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	Equal	Equal	Equal	Equal
Compare potential for impact on future land use plans	First	First	First	Second
Compare potential for displacement or disruption of heritage or archaeological resources	Equal	Equal	Equal	Equal
Compare potential for impacts to public health and safety (air quality)	Equal	Equal	Equal	Equal
Social-Cultural Ranking	First	First	First	Second

Economics

The Economic Considerations Criteria Group includes an assessment of the extent of displacement or disruption to existing business and natural resources for industry (i.e., agriculture, forestry, and mining). The following describes the difference between the options for each criterion. The overall ranking of the options from an economics perspective is shown in **Table 5.8**.

Compare potential for displacement or disruption on agriculture / forestry / mining resource; *Compare potential for displacement or disruption to existing businesses;* – As there are no agricultural, forestry, or mining resources on-site there is no impact to these industries by any of the options (i.e., they are all ranked equally). While there are sand and gravel resources off-site, it is not expected that expansion activities for any options would affect the available resource. For those existing businesses in the off-site study area, all options will have a similar disruption impact to staff and clients (Notably Option 4 has a greater potential for disruption effects and visual impact since the southern expansion area is closest to businesses including a campground.

Overall Economics Ranking – Option 4 is less preferred due to its potential for displacement or disruption on existing businesses. Thus, Options 1, 2, and 3 were preferred.

Table 5.8
ECONOMICS CRITERIA GROUP RANKING SUMMARY

Criteria	Option 1 – West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Compare potential for displacement or disruption to existing businesses	First	First	First	Second
Compare potential for displacement or disruption on agriculture / forestry / mining resource	Equal	Equal	Equal	Equal
Economics Ranking	First	First	First	Second

Cost

When evaluating cost, the sole criterion is an assessment of the potential lifecycle cost. This was assessed by the placement (low, medium, high) within the estimated range of landfill tipping fee cost. The range is estimated to be from $73 to $80 (2012 dollars) per tonne of waste. (Tipping fee would increase in line with future rates of inflation.) The overall ranking of the options from an cost perspective is shown in **Table 5.9**.

Compare potential lifecycle cost of alternative – Options 1 and 2 are both in the low end of the range for lifecycle costs, but for different reasons. Option 1 requires the relocation of the public drop-off depot, maintenance building, scale house, scales, and internal roads. However, it does not require a liner overlapping the existing fill area. Alternatively, Option 2 does not require relocation of infrastructure but has an increased area to landfill compared to Option 1 and requires placement of a liner over the existing fill area.

Option 4 is in the middle of the $73 to $80 per tonne landfill tipping fee range. This is because it requires relocation of the Household Hazardous waste Depot (former Elementa pilot facility) and landfill gas management blower/flare station. It also requires an increased area to be lined relative to Options 1 and 2, but does not require a liner or drainage layer over the existing waste.

Option 3 is in the high end of the lifecycle cost range since it requires relocation of the same infrastructure as in Option 1, as well as a liner over the existing fill area, and has the greatest area to landfill.

Overall Cost Ranking – Option 3 is the least preferred due to its higher lifecycle cost. Option 4 is less preferred as it is in the middle of the lifecycle cost range. Options 1 and

2 are the preferred option for the cost criteria group since it is in the low end of the lifecycle range.

Table 5.9
Cost Criteria Group Ranking Summary

Criteria	Option 1 – West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Compare potential lifecycle cost of alternative	First	First	Third	Second
Cost Ranking	First	First	Third	Second

Technical Considerations

In the evaluation of Technical Considerations Criteria Group, the ease of implementation of the landfill expansion was considered by assessing the ease of site development and operation and the existing/proposed infrastructure as indicators. The following summarizes the results of the evaluation which are also presented in **Table 5.10**.

Compare ease of implementation – For the impact on existing/proposed infrastructure, Option 2 does not require relocation of any principle facilities. Option 4 would require the relocation of the Household Hazardous Waste Depot (i.e. former Elementa facility) and blower/flare station. Options 1 and 3 require the relocation of the public drop-off area, scales, scale house, and maintenance building. Landfill sequencing could allow the relocation of this infrastructure to be delayed allowing it to operate in its current location for a period of time.

When assessing the ease of site development indicator, available surplus soil, disposal capacity, footprint configuration, and average depth of the west expansion were evaluated. All options have a surplus of soil for cover needs. Option 3 provides the target disposal capacity with current waste density, while Options 1 and 4 require a 30% increase in waste density to achieve target disposal capacity. Option 2 also meets the target disposal capacity with current waste density; however, it results in development challenges such as storm water management in vicinity of the existing public drop-off area. The average depth of the west expansion for Option 3, 11 metres, means it is easier for operators to develop the fill area – compared to 18 metres for the other Options. Additionally, Option 4 is unique in that it may require more intense operational controls due to its proximity to Fifth Line East despite the assumed 100 metre buffer.

Overall Technical Considerations Ranking - While Option 3 requires more on-site infrastructure relocation these relocations can be delayed based on site design, and this option is more favourable in terms of footprint configuration and average excavation depth. Thus, Option 3 is the preferred option.

Table 5.10 TECHNICAL CONSIDERATIONS CRITERIA GROUP RANKING SUMMARY				
Criteria	**Option 1 – West Expansion**	**Option 2 – West and North Expansion A**	**Option 3 – West and North Expansion B**	**Option 4 – West and South Expansion**
Compare ease of implementation	Third	Second	First	Fourth
Technical Considerations Ranking	Third	Second	First	Fourth

Transportation

The Transportation Considerations Criteria Group evaluates three criteria – *the potential for effects on airports, truck traffic volume, and truck traffic impact on movement of farm equipment.* **Table 5.11** presents the results of the evaluation of the transportation conditions, which are also described below.

Compare potential for effects on airports; Compare potential for effects on traffic volumes; Compare potential for impacts of haulage truck traffic on the movement of farm equipment – All options have equal (minimal) impact for these three transportation criteria. The landfill site is 25 km from the nearest airport, so all options easily meet the 15 km radius recommended from Transport Canada (to reduce risk of bird strikes). All options will use the same haul routes and manage the same quantity of waste. Therefore the truck kilometres travelled, the intersections traversed, and the impact of trucks travelling through agricultural areas will be the same for all options.

Overall Transportation Ranking – Unlike other criteria groups, all indicators for the three criteria are ranked equally for all Options. As a result, no Option is preferred from the perspective of transportation.

Table 5.11 TRANSPORTATION CRITERIA GROUP RANKING SUMMARY				
Criteria	**Option 1 – West Expansion**	**Option 2 – West and North Expansion A**	**Option 3 – West and North Expansion B**	**Option 4 – West and South Expansion**
Compare potential for affects on airports	Equal	Equal	Equal	Equal
Compare potential for affects on traffic volumes	Equal	Equal	Equal	Equal
Compare potential for impacts of haulage truck traffic on the movement of farm equipment	Equal	Equal	Equal	Equal
Transportation Ranking	Equal	Equal	Equal	Equal

Table 5.5
EVALUATION OF GEOMETRIC EXPANSION OPTIONS
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Natural Environment					
Compare potential for displacement or disruption of terrestrial features	• Area and significance of terrestrial features on site that would be displaced	***Ranked First***: Requires 16.7 ha of land for footprint area and displaces 6.9 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests.	***Ranked First***: Requires 17.1 ha for footprint area and displaces 7.1 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests.	***Ranked First***: Requires 20.2 ha for footprint area and displaces 7.7 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests.	***Ranked Second***: Requires 20.0 ha for footprint area and displaces 16.1 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests. However, as this Option removes more forested lands than Options 1-3 and encroaches into a wetland feature, it is considered less preferred.
	• Area and significance of terrestrial features off-site that may experience disruption effects during operation.	***Ranked Equally***: All site expansion options have the same potential for disruption impacts off-site.	***Ranked Equally***: All site expansion options have the same potential for disruption impacts off-site.	***Ranked Equally***: All site expansion options have the same potential for disruption impacts off-site.	***Ranked Equally***: All site expansion options have the same potential for disruption impacts off-site.
Compare potential for displacement or disruption of aquatic features	• Amount and significance of aquatic habitat on-site that would be displaced or disrupted	***Ranked First***: Options 1-3 are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.	***Ranked First***: Options 1-3 are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.	***Ranked First***: Options 1-3 are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.	***Ranked Second***: Greatest potential for disruption and/or alteration of aquatic habitat as this option overlaps a tributary to the Root River.
	• Amount and significance of aquatic habitat off-site that may be disrupted during operation	***Ranked First***: Low potential for disruption of downstream aquatic habitat.	***Ranked First***: Low potential for disruption of downstream aquatic habitat	***Ranked First***: Low potential for disruption of downstream aquatic habitat	***Ranked Second:*** Greatest potential for disruption of aquatic habitat downstream as this option is close to the Root River.
Compare potential for effects on groundwater resources	• Effect on management of existing site impacts	***Ranked Second***: Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary.	***Ranked First***: Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts.	***Ranked First***: Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts (covers approximately 15% more area than Option 2).	***Ranked Second***: Allows for continued use of existing northern purge wells but has less opportunity to create a horizontal collector in west.
	• Groundwater monitoring requirements	***Ranked First***: Groundwater monitoring requirements similar for Options 1-3.	***Ranked First***: Groundwater monitoring requirements similar for Options 1-3.	***Ranked First***: Groundwater monitoring requirements similar for Options 1-3.	***Ranked Second:*** Groundwater monitoring requirements increased by having three distinct fill areas.
	• Contingency options for new fill area.	***Ranked First***: Contingency options for new fill area similar for Options 1-3.	***Ranked First***: Contingency options for new fill area similar for Options 1-3.	***Ranked First***: Contingency options for new fill area similar for Options 1-3.	***Ranked Second:*** Three fill areas create potential areas where contingency measures would be required.
Compare potential for effects on surface water resources	• Effect on management of existing site impacts	***Ranked First***: Option does not affect present mitigation of surface water impacts from the existing site.	***Ranked First***: Option does not affect present mitigation of surface water impacts from the existing site.	***Ranked First***: Option does not affect present mitigation of surface water impacts from the existing site.	***Ranked Second:*** Southern fill area may impact management of existing site impacts.
	• Surface water monitoring requirements	***Ranked First***: No change in surface water monitoring requirements.	***Ranked Second***: Expansion in the north may require a small change in surface water monitoring requirements.	***Ranked Second***: Expansion in the north may require a small change in surface water monitoring requirements.	***Ranked Third:*** Southern fill area will increase surface water monitoring requirements.

Table 5.5
EVALUATION OF GEOMETRIC EXPANSION OPTIONS
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
	• Contingency options for new fill area.	***Ranked First***: No surface water features in vicinity of western expansion reduces potential need for contingency measures.	***Ranked Second***: Northern expansion requires consideration of contingency measures for Canon Creek in the north.	***Ranked Second***: Northern expansion requires consideration of contingency measures for Canon Creek in the north.	***Ranked Third***: Southern fill area requires contingency measures for the former meander area.
Social-Cultural Environment					
Compare potential for displacement or disruption to residents	• Number of residences on-site who would be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no residences will be displaced.
	• Number of residences off-site who may experience disruption effects (e.g. noise, dust, odour) during operation.	***Ranked First:*** There are approximately 97 residences within 1 km of the off-site study area.	***Ranked First:*** There are approximately 94 residences within 1 km of the off-site study area.	***Ranked First:*** There are approximately 97 residences within 1 km of the off-site study area.	***Ranked Second:*** There are approximately 95 residences within 1 km of the off-site study area. Greater potential for disruption effects and visual impact since the southern expansion area is closest to residences.
	• Character of the community in the vicinity of the site and potential for impact on that character	***Ranked Equally***: All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	***Ranked Equally***: All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	***Ranked Equally***: All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	***Ranked Equally***: All site expansion options have the same potential to impact the character of the community in the vicinity of the site.
Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	• Number and type of community features on-site that would be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no community features will be displaced.
	• Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.	***Ranked Equally***: There are no community features within 1km of the off-site study area.	***Ranked Equally***: There are no community features within 1km of the off-site study area.	***Ranked Equally***: There are no community features within 1km of the off-site study area.	***Ranked Equally***: There are no community features within 1km of the off-site study area.
Compare potential for impact on future land use plans	• Area and designation of land to be displaced on-site	***Ranked Equally***: Requires 16.7 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	***Ranked Equally***: Requires 17.1 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	***Ranked Equally***: Requires 20.2 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	***Ranked Equally***: Requires 20 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.
	• Area and designation of land to be disrupted off-site	***Ranked First***: All site expansion options have the same land use designation (Rural Area).	***Ranked First***: All site expansion options have the same land use designation (Rural Area).	***Ranked First***: All site expansion options have the same land use designation (Rural Area).	***Ranked Second:*** All site expansion options have the same land use designation (Rural Area). Option 4 is closest to an Environmental Management designation (Root River).
	• Change in land use character compared to existing designations	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.

Table 5.5
EVALUATION OF GEOMETRIC EXPANSION OPTIONS
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Compare potential for displacement or disruption of heritage or archaeological resources	• Presence of known archaeological resources on-site	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.
	• Number of built heritage or cultural landscape features on-site that would be displaced	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.
	• Number of built heritage or cultural landscape features off-site that might be disrupted	***Ranked Equally***: There are no built heritage or cultural landscape features within 1 km of the off-site study area.	***Ranked Equally***: There are no built heritage or cultural landscape features within 1 km of the off-site study area.	***Ranked Equally***: There are no built heritage or cultural landscape features within 1 km of the off-site study area.	***Ranked Equally***: There are no built heritage or cultural landscape features within 1 km of the off-site study area.
Compare potential for impacts to public health and safety (air quality)	• Ability to meet provincial regulations	***Ranked Equally***: All options have been designed to meet provincial regulations.	***Ranked Equally*****:** All options have been designed to meet provincial regulations.	***Ranked Equally*****:** All options have been designed to meet provincial regulations.	***Ranked Equally:*** All options have been designed to meet provincial regulations.
Economics					
Compare potential for displacement or disruption to existing businesses	• Number, type and sensitivity of businesses on-site that would be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no business will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no business will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no business will be displaced.	***Ranked Equally***: All site expansion options are located within the existing property boundary and therefore no business will be displaced.
	• Number, type and sensitivity of businesses off-site that might experience disruption effects during operation	***Ranked First***: There are approximately 32 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects.	***Ranked First***: There are approximately 31 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects.	***Ranked First***: There are approximately 32 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects.	***Ranked Second***: There are approximately 31 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects. Greater potential for disruption effects and visual impact since the southern expansion area is closest to businesses including a public campground.
Compare potential for displacement or disruption on agriculture / forestry / mining resources	• Area of on-site agriculture/forestry or mining industry resources that would be displaced	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.
	• Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.
Cost					
Compare potential lifecycle cost of alternative	• Placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high)	***Ranked First***: The estimated range in tipping fees for all Options is $73 to $80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate	***Ranked First***: The estimated range in tipping fees for all Options is $73 to $80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate	***Ranked Third:*** The estimated range in tipping fees for all Options is $73 to $80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate	***Ranked Second***: The estimated range in tipping fees for all Options is $73 to $80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate

Table 5.5
EVALUATION OF GEOMETRIC EXPANSION OPTIONS
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
		with inflation in the future. Option 1 is in the low end of the range as it requires the relocation of the public drop off depot, maintenance building, scale house, scales and internal roads but does not require a liner overlapping the existing fill area.	with inflation in the future. Option 2 is in the low end of the range and doesn't require any relocation but has an increased area to landfill (compared to Option 1) and placement of a liner over the existing fill area.	with inflation in the future. Option 3 is in the high end of the range as it requires relocation of the same infrastructure in Option 1, a liner installed over the existing fill area and has the greatest area to landfill.	with inflation in the future. Option 4 is in the middle of the range as it requires relocation of the Household Hazardous Waste Depot (i.e. former Elementa pilot facility) and landfill gas management blower/flare station, requires an increased area to be lined relative to Options 1 and 2 but does not require a liner or drainage layer over the existing waste.
Technical Considerations					
Compare ease of implementation	• Ease of site development and operation	***Ranked Third:*** Would need to increase waste density by 30% to achieve target disposal capacity. Proposed footprint configuration is easily developed. All options have a surplus of soil for cover needs. The average depth of west expansion is 18 m.	***Ranked Second***: Provides the target disposal capacity with current waste density. Footprint configuration is somewhat awkward with development challenges including storm water management in vicinity of existing public drop-off area. All options have a surplus of soil for cover needs. The average depth of west expansion is 18 m.	***Ranked First***: Provides the target disposal capacity with current waste density. Footprint configuration is enhanced relative to option 2. All options have a surplus of soil for cover needs. The average depth of west expansion is 11 m. A shallower excavation depth will be easier for operators to develop the fill area.	***Ranked Fourth***: Would need to increase waste density by 30% to achieve target disposal capacity. Proposed footprint configuration is easily developed. Although a 100 m buffer has been assumed, more intense operational controls may be required due to the proximity to Fifth Line East. All options have a surplus of soil for cover needs. The average depth of west expansion is 18 m.
	• Effects on existing / proposed landfill infrastructure	***Ranked Third***: Most notably would require relocation of public drop off area, scales, scale house and maintenance building.	***Ranked First***: No relocation of principle facilities would be required.	***Ranked Third***: Most notably would require relocation of public drop off area, scales, scale house and maintenance building. The timing of facility relocation can likely be deferred for a number of years.	***Ranked Second***: Most notably would require relocation of the Household Hazardous Waste Depot (i.e former Elementa facility) and blower/flare station.
Transportation					
Compare potential for affects on airports	• Distance from Sault Ste. Marie airport	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).
Compare potential for affects on traffic volumes	• Annual truck kilometres travelled and character of roadway (i.e. single lane one direction, multi-lane)	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.

Table 5.5
EVALUATION OF GEOMETRIC EXPANSION OPTIONS
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
	• Annual number of trucks travelling through intersections	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.
Compare potential for impacts of haulage truck traffic on the movement of farm equipment	• Annual number of trucks travelling through agricultural areas	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.

5.2.4 Overall Evaluation of Alternatives

The overall evaluation of alternatives involved consideration of the ranking of alternatives for each criteria group. **Table 5.12** shows the criteria group ranking summary. Shading is used to highlight the ranking of the alternatives with darker colour representing the preferred alternative within each criteria group.

Table 5.12
CRITERIA GROUP RANKING SUMMARY

Criteria Group	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
Natural Environment	Second	First	First	Third
Social-Cultural Environment	First	First	First	Second
Economics	First	First	First	Second
Cost	First	First	Third	Second
Technical Considerations	Third	Second	First	Fourth
Transportation	Equal	Equal	Equal	Equal

Table 5.12 shows that Options 2 and 3 are equal to or preferred over Options 1 and 4 for all criteria groups except for cost where Option 3 was least preferred.

To determine the preferred alternative Option 2 and Option 3 were compared to identify the advantages and disadvantages with each alternative and to discuss the trade-offs between criteria groups and the rationale for selecting one alternative over another as preferred.

Options 2 and 3 are considered to be equal to each other for all criteria groups except Cost and Technical Considerations. From a cost perspective, Option 3 is anticipated to have a greater cost than Option 2 as it requires the relocation of more on-site facilities including the public drop off area, scales and maintenance building. From the perspective of technical considerations, Option 3 is preferred over Option 2 as the site configuration is shallower resulting in easier excavation and the footprint configuration is easier to work with (e.g. for Option 2, the footprint configuration results in the storm water management pond in the vicinity of the public drop-off).

Overall the disadvantage of a higher cost was outweighed by the site configuration advantages realized through Option 3. Thus, Option 3 was considered the preferred geometric expansion option.

5.2.5 Consideration of Landfill Mining

Landfill mining was considered as option to expand the City's landfill. Landfill mining was not considered as an alternative method on its own but rather in combination with a footprint expansion. Landfill mining involves excavating disposed waste and cover material, recovering recyclable materials and cover material and returning the waste to the disposal foot print. Landfill mining has been used on landfills in Ontario to create additional capacity and/or mitigate impacts to groundwater.

The City of Barrie was contacted in June 2011 to obtain information on their ongoing landfill mining project. A site visit was also conducted on October 14, 2014. The main purpose of the mining project is to protect groundwater by installing a landfill liner and a leachate collection system. The process involves the excavation of previously disposed waste and cover material. The mined waste is fed through screens to separate the coarse waste from the fine materials. Coarse waste is transported to the active landfill face, materials that can be recycled are separated and sent for further processing and the fines (primarily sand) are saved for future use as a daily cover. It is estimated that 50% of landfill capacity is gained as a result of mining operations.

On average, the City of Barrie is mining approximately 1,000 m^3 per day and estimates it will take between 5 to 6 years to finish mining 1.6 million m^3 of waste. Waste densities achieved before the re-engineering of the landfill were between 650 and 750 kg/m^3 and they estimate that the current density is almost double. This is because the in-situ waste has decayed making it more malleable and mixes well with fresh municipal solid waste. They estimate that landfill mining will increase the life of the landfill from 2017 to 2024.

The City of Barrie began landfill mining operations in the winter of 2009 and has received consistent complaints on odour since then (particularly during hot summer periods where the City received an average of 10 odour complaints/day). The Barrie landfill is in close proximity to residential areas on three of its sides therefore, the City has had to take measures to mitigate odour issues through the use of masking agents, aerosols, and foam canons for cover, and limiting the area that is uncovered during the mining process. The City had air quality assessments completed to confirm they were within MOECC air quality limits.

Once a preferred footprint expansion option was selected for the City of Sault Ste. Marie, it was then evaluated on its potential to add a landfill mining component. The location to mine landfilled waste was selected based on improving groundwater conditions in the western portion of the existing disposal footprint. There exists a groundwater divide (runs north-south) in the central portion of the existing landfill. The footprint for landfill mining was selected based on the opportunity to enhance mitigation to the south and south-west through the installation of a liner to the west of the groundwater divide.

The evaluation of geometric expansion options revealed that Option 3 is preferred. The advantages and disadvantages of adding a landfill mining component within the western portion of the existing disposal footprint for Option 3 was considered. The same criteria

and indicators used for the landfill expansion evaluation were used for this comparison. **Table 5.13** documents the data collected and the preference ranking of the Option 3 without landfill mining and Option 3 with landfill mining. For the majority of the indicators, the two options were considered to be equal. The key areas of difference are as follows:

- *Potential for effects on groundwater resources* – Option 3 with landfill mining is preferred as the removal of existing fill and installation of a liner allows for further mitigation / reduction of existing site impacts.
- *Potential for displacement or disruption to residents* – Option 3 without landfill mining is preferred as neighbouring residents will not experience odour effects due to landfill mining. The mining operation is expected to continue for a couple of years.
- *Compare potential for impacts to public health and safety (air quality)* – Option 3 without landfill mining is preferred. All options have been designed to meet provincial regulations. However, additional mitigation measures may be required to address concerns as a result of landfill mining. Based on other landfill mining work in Ontario, concerns can likely be mitigated.
- *Potential for displacement or disruption to existing businesses* - Option 3 without landfill mining is preferred as staff and clients from local businesses are expected to experience less disruption effects with no landfill mining.
- *Ease of implementation* – Option 3 without landfill mining is preferred as landfill mining will require ongoing odour mitigation during landfill mining activities.

While Option 3 without landfill mining is preferred for more criteria, it was determined that Option 3 with landfill mining provided the opportunity to implement long term improvements to ground water quality. The short term nuisance effects associated with landfill mining were considered manageable given the long term benefit of removing the waste in the western portion of the landfill and lining that area for better groundwater protection.

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
Natural Environment			
Compare potential for displacement or disruption of terrestrial features	• Area and significance of terrestrial features on site that would be displaced	***Ranked Equally***: Requires 20.2 ha for footprint area and displaces 7.7 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests.	***Ranked Equally***: Requires 20.1 ha for footprint area and displaces 7.7 ha of forested area. These lands are within the existing landfill site boundary and are not identified as significant forests.
	• Area and	***Ranked Equally***: Both options	***Ranked Equally***: Both

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
	significance of terrestrial features off-site that may experience disruption effects during operation.	have the same potential for disruption impacts off-site.	options have the same potential for disruption impacts off-site.
Compare potential for displacement or disruption of aquatic features	• Amount and significance of aquatic habitat on-site that would be displaced or disrupted	***Ranked Equally***: Both options are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.	***Ranked Equally***: Both options are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.
	• Amount and significance of aquatic habitat off-site that may be disrupted during operation	***Ranked Equally***: Low potential for disruption of downstream aquatic habitat	***Ranked Equally***: Low potential for disruption of downstream aquatic habitat
Compare potential for effects on groundwater resources	• Effect on management of existing site impacts	***Ranked Second***: Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts.	***Ranked First***: Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts. Landfill mining of existing fill and installation of a liner allows for further mitigation / reduction of existing site impacts.
	• Groundwater monitoring requirements	***Ranked Equally***: Groundwater monitoring requirements similar for both options.	***Ranked Equally***: Groundwater monitoring requirements similar for both options.
	• Contingency options for new fill area.	***Ranked Equally***: Contingency options for new fill area similar for both options.	***Ranked Equally***: Contingency options for new fill area similar for both options.

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
Compare potential for effects on surface water resources	• Effect on management of existing site impacts	***Ranked Equally***: Option does not affect present mitigation of surface water impacts from the existing site.	***Ranked Equally***: Option does not affect present mitigation of surface water impacts from the existing site.
	• Surface water monitoring requirements	***Ranked Equally***: Expansion in the north may require a small change in surface water monitoring requirements.	***Ranked Equally***: Expansion in the north may require a small change in surface water monitoring requirements.
	• Contingency options for new fill area.	***Ranked Equally***: Northern expansion requires consideration of contingency measures for Canon Creek in the north.	***Ranked Equally***: Northern expansion requires consideration of contingency measures for Canon Creek in north.
Social-Cultural Environment			
Compare potential for displacement or disruption to residents	• Number of residences on-site who would be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no residences will be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no residences will be displaced.
	• Number of residences off-site who may experience disruption effects (e.g. noise, dust, odour) during operation.	***Ranked First:*** There are 97 residences within 1 km of the off-site study area.	***Ranked Second:*** There are 97 residences within 1 km of the off-site study area. Neighbouring residents may experience odour effects due to landfill mining. The mining operation is expected to continue for a couple of years.
	• Character of the community in the vicinity of the site and potential for impact on that character	***Ranked Equally***: Both options have the same potential to impact the character of the community in the vicinity of the site.	***Ranked Equally***: Both options have the same potential to impact the character of the community in the vicinity of the site.

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)	• Number and type of community features on-site that would be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no community features will be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no community features will be displaced.
	• Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.	***Ranked Equally***: There are no community features within 1 km of the off-site study area.	***Ranked Equally***: There are no community features within 1 km of the off-site study area.
Compare potential for impact on future land use plans	• Area and designation of land to be displaced on-site	***Ranked Equally***: Requires 20.2 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	***Ranked Equally***: Requires 20.2 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.
	• Area and designation of land to be disrupted off-site	***Ranked Equally***: All site expansion options have the same land use designation (Rural Area).	***Ranked Equally:*** All site expansion options have the same land use designation (Rural Area).
	• Change in land use character compared to existing designations	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	***Ranked Equally***: The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.
Compare potential for displacement or disruption of heritage or archaeological resources	• Presence of known archaeological resources on-site	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.	***Ranked Equally***: All site expansion options are located on the same site where there are no known archaeological resources on-site.
	• Number of built heritage or cultural landscape features on-site that would be displaced	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	***Ranked Equally***: There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.
	• Number of built heritage or cultural	***Ranked Equally***: There are no	***Ranked Equally***: There

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
	landscape features off-site that might be disrupted	built heritage or cultural landscape features within 1 km of the off-site study area.	are no built heritage or cultural landscape features within 1 km of the off-site study area.
Compare potential for impacts to public health and safety (air quality)	• Ability to meet provincial regulations	***Ranked First*****:** All options have been designed to meet provincial regulations.	***Ranked Second***: All options have been designed to meet provincial regulations. Additional mitigation measures may be required to address concerns as a result of landfill mining. Based on other landfill mining work in Ontario, concerns can likely be mitigated.
Economics			
Compare potential for displacement or disruption to existing businesses	• Number, type and sensitivity of businesses on-site that would be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no business will be displaced.	***Ranked Equally***: Both options are located within the existing property boundary and therefore no business will be displaced.
	• Number, type and sensitivity of businesses off-site that might experience disruption effects during operation	***Ranked First***: There are 32 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects.	***Ranked Second***: There are 32 businesses within 1 km of the off-site study area. Staff and clients may experience some disruption effects including increased odour effects due to landfill mining.
Compare potential for displacement or disruption on agriculture / forestry / mining resources	• Area of on-site agriculture/forestry or mining industry resources that would be displaced	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	***Ranked Equally***: There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.
	• Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	***Ranked Equally***: There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.
Cost			
Compare potential	• Estimated lifecycle	***Ranked First:*** The estimated	***Ranked Second***: The

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
lifecycle cost of alternative	cost	tipping fee for this Option is $80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.	estimated tipping fee for this Option is $88 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future. Landfill mining increases the area to be lined and will require purchase of additional equipment and require additional mitigation measures and therefore will be higher than Option 3 without landfill mining.
Technical Considerations			
Compare ease of implementation	• Ease of site development and operation	***Ranked First***: Provides the target disposal capacity with current waste density. All options have a surplus of soil for cover needs. The average depth of west expansion is 11 m.	***Ranked Second***: Provides the target disposal capacity. Will require ongoing odour mitigation during landfill mining activities. All options have a surplus of soil for cover needs. The average depth of west expansion is 11 m.
	• Effects on existing / proposed landfill infrastructure	***Ranked Equally***: Most notably would require relocation of public drop off area, scales and scale house and maintenance building.	***Ranked Equally:*** Most notably would require relocation of public drop-off area, scales and scale house and maintenance building.
Transportation			
Compare potential for affects on airports	• Distance from Sault Ste. Marie airport	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	***Ranked Equally***: Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).

Table 5.13
EVALUATION OF PREFERRED GEOMETRIC EXPANSION OPTION WITH AND WITHOUT LANDFILL MINING
(expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
Compare potential for affects on traffic volumes[14]	• Annual truck kilometres travelled and character of roadway (i.e. single lane one direction, multi-lane)	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.
	• Annual number of trucks travelling through intersections	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.
Compare potential for impacts of haulage truck traffic on the movement of farm equipment	• Annual number of trucks travelling through agricultural areas	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	***Ranked Equally***: All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.

[14] The waste haul route for this criterion includes public roads from the main waste generation points to each site alternative.

6.0 DESCRIPTION OF THE PROPOSED FACILITY

This section of the EA summarizes the design of the proposed expansion and discusses how it will be constructed and operated. The complete Design and Operations Report for the proposed expansion is provided in **Appendix C.**

Table 6.1
SUMMARY OF THE PROPOSED UNDERTAKING

Parameter	Description
Service Area	City of Sault Ste. Marie, Prince Township and Rankin Reserve
Waste Type	Solid residential, industrial, commercial and institutional (IC&I), construction and demolition (C&D) wastes and biosolids
Maximum Rate of Fill	78500 tonnes/year
Total Site Area	Original approval: 83.6 ha Current: 145.4 ha
Fill Area	Existing Fill Area as per 1990 D & O Report Drawings: 25.8 ha Proposed Expansion Fill Area Addition: 17.8 ha Existing Fill Area plus Proposed Expansion Fill Area Addition: 43.6 ha Proposed Mining Area (included in the Existing Fill Area): 3.4 ha
Total Waste Disposal Volume (Waste and Daily/Intermediate Cover)	Currently Approved as per 1990 D & O Report: 2,260,000 m^3 (excluding the original Cherokee Landfill capacity)Proposed Expansion: 4,200,000 m^3 Currently Approved plus Expansion: 6,460,000 m^3
Apparent Waste Density*	0.56 t/m^3 (based on experience with the existing site)
Estimated Disposal Capacity**	2,352,000 t for the proposed expansion 3,617,600 t for the existing and proposed expansion combined
Maximum Top of Final Cover	314.3 m ALS - proposed
Minimum Bottom of Excavation	274 m ASL - proposed

*Apparent waste density is defined as the weight (tonnes) of waste divided by the volume of waste and daily/intermediate cover.
** Tonnes of waste only (i.e. cover material not included).

6.1 Waste Quantities and Characteristics

Service Area

The service area will remain unchanged, i.e. the City of Sault Ste. Marie, the Township of Prince and the Batchewana First Nation's Rankin Reserve.

Waste Characteristics

The Landfill is approved to accept solid non-hazardous residential, industrial, commercial and institutional (IC&I), and construction and demolition (C&D) waste, and biosolids. This includes waste generated by the City's operations. No changes to the types of waste are proposed.

Waste Quantities

It is forecasted that waste will be landfilled at a maximum rate of 73,200 tonnes per year. For the purposes of the ECA approval, the proposed maximum fill rate is 78,500 to provide some flexibility for contingencies.

6.2 LANDFILL EXPANSION DESIGN

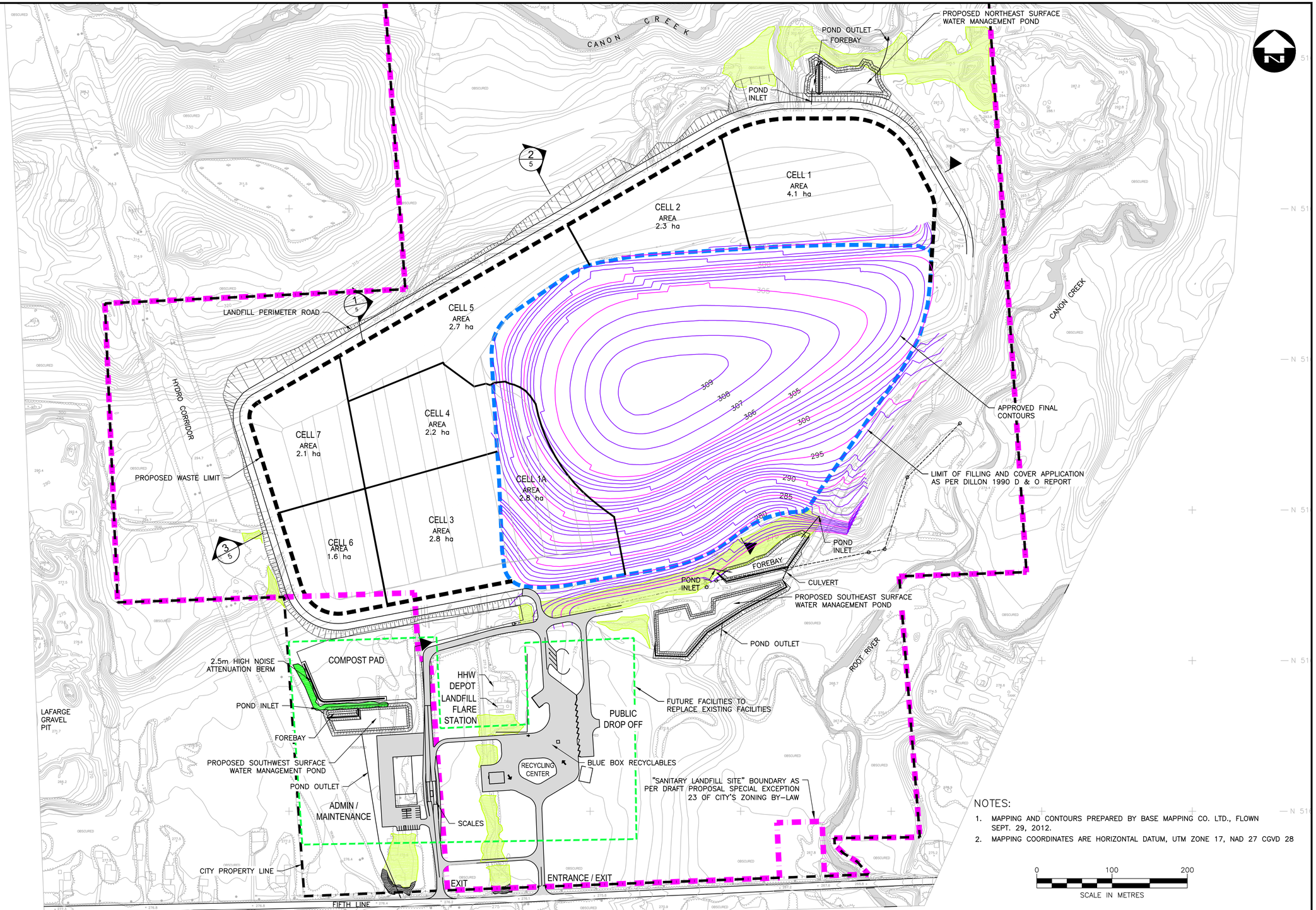
It is proposed to expand the existing landfill by an additional disposal capacity of 4.2 million m^3 of waste and daily/intermediate cover (including disposal capacity associated with mining as described in Section 6.3). The proposed expansion will comprise of north and west horizontal expansions and a moderate vertical expansion. The existing site has an existing fill area of 25.8 hectares as per 1990 D & O Report Drawings. The horizontal expansion will add a waste footprint of 17.8 hectares, for a total footprint of 43.6 hectares. The proposed modest vertical expansion will increase the landfill height by approximately 4 metres (from elevation 310 m ALS to 314.3 m ALS). **Figure 6.1** shows the conceptual design for the Sault Ste. Marie Landfill expansion.

Landfill Design Criteria

Ontario Regulation 347, made under Part V of the *Environmental Protection Act*, defines landfilling as:

> "The disposal of waste by deposit, under controlled conditions, on land or on land covered by water, and includes compaction of the waste into a cell and covering the waste with cover materials at regular intervals."

The Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfill Sites (MOECC 2012) gives directions on the appropriate methods and approaches for landfill design, operation, closure and post-closure maintenance. The Guide to Applying for an Environmental Compliance Approval (MOECC, 2012) is also relevant to this application.



NOTES:

1. MAPPING AND CONTOURS PREPARED BY BASE MAPPING CO. LTD., FLOWN SEPT. 29, 2012.
2. MAPPING COORDINATES ARE HORIZONTAL DATUM, UTM ZONE 17, NAD 27 CGVD 28

0 100 200
SCALE IN METRES

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

LICENSED PROFESSIONAL ENGINEER
Mar 2/17
F. R. Gondim
100087085
PROVINCE OF ONTARIO

AECOM

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY
1	SUPPLEMENT TO EA REPORT	2015/03/31	F.R.G.

DESIGN F.R.G.	REVIEWED BY F.R.G.
DRAWN D.B.C./S.K.B.	CHECKED BY F.R.G.
DATE MARCH 2015	
SCALE 1:2500	

SAULT STE. MARIE MUNICIPAL LANDFILL SITE
DESIGN AND OPERATIONS REPORT

PROJECT NO. 06-6988

Figure No. 6.1

The conceptual design of the landfill expansion has been prepared in accordance with these and other MOECC regulations, policies and guidelines. The following parameters were used in the expansion design:

- A volumetric capacity for waste and daily/intermediate cover of 4,200,000 m^3 to manage 2,352,000 tonnes of waste assuming an apparent density of 0.56 t/m^3, including capacity generated by mining operations.
- Maximum 4 horizontal to 1 vertical (4:1) above-ground side slopes up to 10 m high.
- Maximum 6:1 above-ground side slopes above 10 m high.
- Minimum 20:1 for top slopes.
- Maximum 3:1 excavation side slopes.
- Apparent density of 560 kg/m3.
- Waste to daily cover ratio of 4:1.
- Final cover depth of 1 m.
- Minimum 30 m setback distance from the property boundary.
- Minimum base of excavation grade of 0.5%.
- A composite liner consisting of a geocomposite clay liner overlaid by a 1.5 mm thick HDPE geomembrane for new landfill cells, including the mined cell.
- A full underdrain leachate collection system consisting of clear stone with thickness varying between 0.3 and 0.8 m and sand protective layer with 0.2 m thickness.
- Transmission of leachate to the sanitary sewer system at Fifth Line/Old Goulais Bay Road.
- Active landfill gas management system.

Other criteria, specific to various features, were established in the conceptual design process.

Limits of Landfilling

The waste limit is the outermost boundary of waste landfilling and was generally established based on site topography, groundwater and surface water divides and buffers and setbacks from property limits. The waste fill area is proposed to increase from 25.8 hectares to 43.6 hectares for a net increase of 17.8 hectares. The proposed mining area of 3.4 hectares is included in the existing 25.8 hectares of waste fill.

The proposed waste fill area will maintain the current setback along the east boundaries, slightly reduce the existing setback along the south boundary and establish a 30 m buffer along the west boundary against the hydro corridor and a 100 m setback along Canon Creek, located north of the Site.

Base Contours and Liner

The base of the proposed landfill expansion area was designed with a minimum 3 m vertical separation from historical groundwater elevation. Borehole logs and available

monitoring data were used to establish the highest recorded water table elevation at applicable monitoring wells. The type of soil recorded in borehole logs was also reviewed.

Generally, the excavation depth below existing ground for the proposed expansion will range from approximately 5 to 13 m. The proposed base grades of the west expansion were influenced by existing site topography:

- The base grades of the north expansion were influenced by landfill geometry, considering constructability, leachate drainage and operations. The base of the proposed north expansion has a high point that divides the base slopes to the east and west. Two sumps will collect leachate from the north and west expansion areas as part of the leachate management system.

- The base of the proposed west expansion area generally slopes towards the southeast corner. The west expansion will have 2.9% longitudinal base slopes (from north to south). The north expansion will have 2.8% and 3% at east and west valleys, respectively.

The proposed composite liner and leachate collection system for the expansion and mining areas will consist of, from bottom to top:

- Cushion geotextile.
- Geosynthetic clay liner.
- 1.5 mm thick high density polyethylene (HDPE) geomembrane.
- Cushion geotextile.
- 0.3 to 0.8 m thick stone drainage layer.
- Separator geotextile.
- 0.2 m thick sand protective layer.

An approximately 1 m high berm will be constructed at the toe of the existing fill areas that are being expanded or mined to separate the lined area from the unlined area. The berm will anchor the liner and geotextiles, provide leachate containment, assist in directing surface water from the unlined areas away from the lined areas and control sediments from entering the lined area.

Final Contours

The final contours were designed in accordance to Regulation 232/98 which requires maximum 4:1 and minimum 20:1(5%) side slopes. Side slopes higher than 10 m were designed with 6:1 slopes as recommended by the *2013 Landfill Expansion – Geotechnical Report*, prepared by AECOM (refer to **Appendix G**)

The maximum elevation of the entire waste fill is 314.3 m ASL, including the 1 m thick final cover, which is a 4.3 m vertical increase compared to the approved final contours at 310 m asl maximum elevation for the existing site.

6.3 Landfill Mining

Landfill mining operations are proposed to be performed in the Cell 1A area indicated on **Figure 6.1**.

Process Description

The contractor selected by the City will choose the means and methods, including equipment, sequence and personnel to complete the mining work based on tender specifications to be prepared by a qualified engineer. The mining process should, in general, be completed according to the following sequence:

- Mobilization - Contractor mobilization, submission and review of health & safety plan, odour mitigation plan, dust and erosion and sedimentation control plans.
- Site preparation - Existing soil cover stripping within the area of Cell 1A to be mined. Soil will be stockpiled for future cover use.
- Waste excavation and pre-separation - The waste excavation will be completed in lifts of approximately 3 m thick by an excavator and/or dozer. Materials that can be reused or recycled will be pre-separated. During waste excavations, large size materials (e.g. tires, metals, concrete, etc.) are to be pre-separated and stockpiled or stored for reuse or recycling, which may include on-site or off-site mechanical processing such as shredding, grinding or crushing.
- Waste screening - Excavated waste materials that are not pre-separated will be loaded by an excavator into screening equipment (e.g. trommel screen). The screening process will mechanically separate fine parts (mainly soil), from the residual materials typically referred to as waste overs.
- Fines - The fines fraction will be hauled to the working face of the active cell to be stockpiled and either used as daily/intermediate cover or re-landfilled. Other uses of fines within the approved waste footprint may be allowed, such as berms or road fill. Pre-approval by the resident inspector will be required for uses other than cover.
- Waste overs - The waste overs will be hauled to the working face of the active cell and immediately re-landfilled along with the regular incoming solid waste materials.
- Compaction and cover - Mined waste that will be re-landfilled will be treated as regular waste and will be compacted and/or mixed with other waste and will be covered with approved daily cover at the end of each operating day.

Before waste excavation can commence, the following activities must be completed:

- Conduct landfill mining trial or pilot to assist in defining best practices for operations and odour management.

- Delineate areas to be mined, areas dedicated to the processing equipment, stockpiles and hazardous or suspect waste storage areas, and provide signs as necessary.
- Develop the Odour Management Plan.
- Implement erosion and sediment control measures.
- Excavate interim/final cover from the area to be mined and stockpile.
- If perched leachate is encountered, collect and dispose of leachate in accordance to the leachate management plan, prior to further excavation.

Existing site drainage should be maintained and modified as necessary to prevent run-on or run-off from the area being mined. In general, mining operations should be confined to designated areas. Additional swales, ditches or berms should be constructed as needed to control surface water drainage.

Mining operations will be monitored and documented to assess the performance of the equipment employed, evaluate the quantity and quality of the various material fractions and to recommend modifications or improvements to the operation.

Fines Management

Based on analytical data available for landfill mining sites in Ontario (e.g. City of Barrie, Northumberland County, Simcoe County and City of Blue Mountains), fines generated from mining operations (primarily soil) either meet or marginally exceed MOECC Tables 1 or 2 criteria. MOECC Tables 1 and 2 are the criteria used to assess maximum acceptable level of contaminants under the Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the *Environmental Protection Act*.

In general, fines will be assumed to be non-hazardous solid waste and will be used within the approved waste fill limit as daily cover, intermediate cover, road fill or temporary berming.

If fines are being considered for on-site use outside the approved waste limits, site specific testing should be conducted. Furthermore, any fines to be used for road fill shall require approval of the City's on-site representative.

Design Considerations

Excavated waste at Cell 1A should be maintained with a stable slope expected to be no flatter that 4:1, with typical waste slopes ranging from 2:1 to 3:1.

A composite liner and leachate collection system consistent with the design for the proposed expansion is proposed for the base of the excavated waste (Cell 1A) for groundwater protection. Leachate will be collected at the base of the lined Cell 1A by a drainage blanket and perforated pipes and conveyed by gravity to the proposed sump located on Cell 3.

A 1 m high berm will be constructed at the toe of the excavated waste to separate the lined area from the unlined area (existing landfill). The berm will anchor the geosynthetic materials (GCL, geomembrane and geotextiles), provide leachate containment, assist in directing surface water from the unlined areas away from the lined area and control sediments from entering the lined area.

Health and Safety Considerations

A site-specific health and safety plan will be prepared prior to commencement of mining operations and will be implemented during mining operations.

The health and safety plan will consider various applicable hazards associated with mining operations and should be in compliance with the City of Sault Ste. Marie policies and procedures and Ministry of Labour regulations. Physical, chemical and biological hazards such as gases (methane, hydrogen sulphide), sharps, wastewater biosolids, asbestos and equipment traffic will be identified and mitigated. The health and safety plan will include specific operating procedures to address air quality/odour, dust, airborne contaminants, personal protective equipment (PPE), decontamination procedures and emergency procedures.

The health and safety plan will include procedures to manage anticipated or confirmed hazardous materials as well as the presence of any material of concern. Any hazardous waste that may be encountered will be properly managed at a licensed facility for proper disposal or processing.

The health and safety plan will also include procedures to operate heavy equipment, processing equipment and tools. Heavy equipment and processing equipment should be provided with engineering controls. Tools should be of adequate design and include engineering controls to provide a safe environment to the site personnel.

Odour Management

A preliminary odour management plan (OMP) was developed as part of this EA and will be further developed and finalized as the landfill mining program evolves and information on contractor's procedures, means and methods are available. A waste mining pilot project will be completed prior to full-scale waste mining activities to further develop and refine the OMP based on actual site conditions.

The final OMP will be specific to the site and proposed equipment means and methods and will be prepared by a consultant retained by the mining contractor (or by the City directly) documenting procedures for odour management. The OMP will be based on the MOECC's recommended FIDOL (frequency, intensity, duration, offensiveness and location) approach.

Environmental parameters such as temperature, humidity, wind direction and speed will be monitored as part of the OMP. Odour mitigation measures to be contemplated include operational and administrative controls such as: adjust work areas to reduce the

amount of exposed waste; place cover material close to the work areas so exposed waste can be covered quickly; transport waste under optimal temperature and wind speed conditions; and use odour suppressant foam and misters where appropriate.

Dust and Airborne Contaminant Management

Mining operations have the potential to generate dust during dry periods (usually in the summer when the ground is dried up by higher temperatures). Dust can be generated by typical mining operations such as cover stripping, waste and soil excavation, screening and heavy equipment and truck traffic.

Dust is a concern because it may reduce visibility, generate airborne contaminants and potentially may become a nuisance to off-site receptors if not controlled at the source. Airborne contaminants should be controlled because they represent a safety hazard to site personnel and should be addressed in the health and safety plan.

A dust and airborne contaminant management plan should be prepared and implemented by the mining contractor and approved by the City and the contract administrator retained by the City. The dust and airborne contaminant management plan should include equipment used to control dust and describe the liquid and rate that will be applied. Monitoring procedures should also be included in the dust and airborne contaminant management plan.

6.4 Landfill Capacity Calculations

The volume between the top of final cover contours and base (excavation) contours of the landfill represents the volume available for the construction of a leachate collection system, the landfilling of waste, and the application of daily, intermediate, and final cover. **Table 6.2** highlights the capacity achieved by the expansion

Table 6.2
LANDFILL CAPACITY

DESCRIPTION	QUANTITY
Disposal capacity generated by expanded waste limit for waste and daily/intermediate cover, estimated from the top of the leachate collection system or top of waste within the existing approved disposal footprint to the underside of the final cover, excluding mining volumes*	4,040,000 m^3
Excavated waste volume generated by mining operations	320,000 m^3
Volume of mining residual waste that will be re-landfilled (assumed 50%)	-160,000 m^3
Total volume of waste plus daily/intermediate cover	**4,200,000 m^3**

*Includes disposal capacity of 115,000 m^3 generated by final cover stripping of the existing site that overlaps with the proposed expansion (153,000 m2 final cover area x 0.75 m final cover thickness).

6.5 Site Features

Various existing facilities will be replaced/relocated as the site is expanded. Most of the replacement site infrastructure/facilities will have to be established prior to initiating development activities in Cell 3. Application(s) for amendment(s) to the site Environmental Compliance Approval will be submitted to the MOECC prior to initiating construction of the replacement site infrastructure. The following general development sequence is suggested for the landfill expansion and proposed facilities, subject to revisions as new options are identified:

- Build the proposed northeast surface water management pond.
- Decommission the existing northeast stormwater management pond.
- Relocate the compost pad before construction of Cell 1.
- Build the proposed southwest surface water management pond as part of the compost pad relocation.
- Build Cell 1.
- Implement the initial phase of the landscape plan per Environmental Management Plan that will be prepared following EA approval. Other phases of the landscape plan will be implemented as per Environmental Management Plan that will be prepared following EA approval.
- Build proposed pump station to serve Cell 1 and associated forcemain. Connect forcemain to the existing pump station.
- Build the east and south perimeter ditches for the existing site and the southeast surface water management pond.
- Build Cell 2.
- Complete a pilot program for Cell 1A mining.
- Proceed and complete full-scale mining operation at Cell 1A.
- Build the liner and leachate collection system for Cell 1A.
- Decommission purge wells within the footprint of Cell 3. Replace purge wells as and if needed (depending on remaining groundwater impacts, if any, after landfill mining is completed)
- Relocate existing Public Drop-Off, Maintenance Garage, Scale House/Administration Building and Scales.
- Build the new entrance/exits.
- Build the Recycling Centre.
- Build the HHW Depot.
- Build the South surface water management pond.
- Build roads to serve the relocated facilities.
- Decommission and remove or repurpose (where not in conflict with future site development) the existing site infrastructure (i.e. Public Drop-Off, Maintenance Garage/Administration Building and Scales/Scale house, HHW Depot).
- Build Cell 3.
- Build proposed pump station to serve Cell 3 and associated forcemain. Connect forcemain to the existing pump station.

- Decommission remaining purge wells. Replace purge wells as and if needed (depending on groundwater impacts, if any, after landfill mining is completed)
- Build Cell 4.
- Build Cell 5.
- Build the horizontal leachate collector (based on a need assessment completed prior to construction of Cells 6 and 7, as per contingency plan).
- Build Cell 6.
- Build Cell 7.

The replacement site infrastructure is described in the following paragraphs.

Site Entrance and On-Site Roads

The site entrance will continue to be provided from Fifth Line. The site entrance will, however, be relocated further east relative to the existing entrance and a separate exit only gate will be provided at the location of the existing entrance. The relocated entrance gate will provide access to both the landfill and the Recycling Centre.

The access roadway to the landfill provides access to the scales and eventually to the public waste drop-off area and the landfill perimeter road.

A 7.2 m wide, 2 lane hard-surfaced landfill perimeter road will be constructed. Drainage ditches, where necessary, will be constructed adjacent to this road.

Access to the landfill working face will be provided via several haul roads departing from the perimeter road. Waste materials, such as wood chips or fines generated by mining operations may be used as an alternative building material for these haul roads. Consideration will be given to the finished surface of the haul roads to reduce dust emissions from waste haul truck traffic.

Scales and Scale House

A weigh scale will be relocated to the south as shown on **Figure 6.1** and will have a set back from the entrance to allow for vehicle queuing on site. The distance from the Fifth Line entrance to the scale will provide adequate queuing length. A scale house equipped with a methane detection system will be provided for the scale attendant.

Administration/Maintenance Building

The existing Administration Building and Maintenance Garage will be replaced/ relocated. The Administration and Maintenance Building will be equipped with a methane detection system.

Stockpiles

Stockpiles will be located within designated areas or adjacent to the active working face. Soil for daily cover will be located near the active working face. Stockpiles shall be sized and managed to minimize the potential for off-site dust.

Drop-Off Area

The site plan has been developed to separate diversion activities from disposal activities. The main entrance to the site will facilitate access to both the waste diversion drop-off area and the weigh scales which are located upstream of the waste disposal drop off-area.

Customers are able to enter the waste diversion drop-off area without passing over the weigh scales. This approach encourages customers to properly manage diversion items as they can be tipped at no charge. The waste diversion drop-off area is configured to facilitate traffic flow in a counter clockwise direction with various diversion stations located along the periphery of the traffic loop. The following diversion stations have been included:

- Metals including appliances and propane tanks;
- Tires;
- Typical blue box recyclables (i.e. fibres and containers);
- Waste electrical and electronic equipment; and
- Household special waste.

Customers can then proceed to the weigh scales and the waste drop-off area once diversion items are discarded. Customers that do not have diversion items may also proceed directly to the weigh scales.

Once passing over the weigh scales customers proceed in a counter clockwise direction through the waste disposal drop-off area. Separate stations have been established for normal household waste, construction and demolition waste and clean wood waste including brush. Typical blue box material recyclable containers are also accessible from the waste disposal drop off area.

Once customers have tipped their waste they will proceed over the outbound weigh scale and pay appropriate charges before exiting the site.

6.6 Environmental Control Measures

6.6.1 Access and On-site Traffic Control

Access to the site is provided from Fifth Line and controlled by a gate which is locked during non-operating hours. Security cameras are also mounted on poles adjacent to the scale house to monitor activity during non-operating hours.

The Site will be supervised during operating hours. This will ensure that vehicles will be directed to an appropriate area (i.e., public drop-off, working face or waste diversion facilities). Traffic control is provided by traffic signals mounted at each end of each weigh scale. Traffic signals are semi-automated and controlled by the weigh scale attendants.

The weigh scale attendants will also be responsible for vetting customers to confirm they reside within the approved service area. This may include questioning customers on the inbound weigh scale or asking them to provide identification to confirm their residency.

6.6.2 Waste Control

Vehicles delivering waste are required to stop at the weigh scale to confirm waste types and vehicle weight with the scale house attendant. If a load is considered "unacceptable," (i.e., waste type or materials not identified on the ECA), the attendant will have the authority to reject the load.

Another opportunity for waste control is at the working area and drop-off areas. Equipment operators and other staff will be trained to recognize non-permitted wastes. If "unacceptable" waste is identified when a vehicle is unloading, it will be reloaded back into the source vehicle for removal. If the source vehicle has left the site, the unacceptable waste will be segregated and the hauler/generator will be contacted and asked to remove the waste promptly. The rejection and action will be recorded and kept with the site operating records.

If a waste is suspected to be hazardous, it will be segregated and assessed. The hauler will be informed of the receipt of the waste, its storage and any testing that is required to confirm the nature of the waste. Each event will be reported to MOECC. If the waste is confirmed to be hazardous, the operator will obtain an Emergency Generator Number and waste number from the MOECC, and arrange to have the waste removed for proper disposal at an approved hazardous waste site. The costs of testing and handling of all suspect waste will be charged to the hauler.

If the waste is proven to be non-hazardous and “acceptable”, results of testing will be provided to the hauler and generator (via the hauler) and the MOECC. The waste will be sent back to the working area for disposal.

6.6.3 Leachate & Groundwater Management

As a minimum, the leachate management system for the proposed expansion will be designed to comply with the requirements of the provincial requirements for surface water quality, and with the requirements of the "Reasonable Use Guideline" for groundwater.

Leachate Collection System

The leachate collection system (LCS) serves to convey generated leachate to a collection point, and to drain the leachate mounding over the liner. The leachate is then pumped through a forcemain to the City's waste water collection system and ultimately to the waste water treatment plant. An assessment of the performance of the leachate collection system and an estimate of the quality and quantity of leachate pumped is addressed in the Annual Monitoring reports.

For the expansion, the proposed LCS consists of the following key components (on top of the liner system):

- Drainage blanket - The drainage blanket will be a continuous layer of 19 mm – 38 mm clear stone with thickness ranging from 0.3 m to 0.8 m over the low permeability base liner.
- Lateral collection pipes and header pipes – The lateral collection pipes (200mm perforated HDPE pipes) will be installed at valleys and will run in a north-south orientation within the proposed west landfill expansion area and from a high point divide to the west and east within the proposed north landfill expansion area. Since the base contours are designed to be sloped towards the lateral collection pipes, leachate from the blanket will be drained to the header pipes which are 200 mm diameter perforated HDPE pipes with the same perforation pattern as the lateral pipes. A geotextile filter will surround the clear stone to prevent migration of soil fines into the perforated collection pipes.
- Pumps - Leachate will drain by gravity to the leachate sumps and pump stations located south and east of the landfill footprint. Collected leachate will be pumped from the sump using submersible stainless steel pumps equipped with all necessary piping, valves, controls, power supply, and flow meters.
- Existing pump station and forcemain – Leachate will be pumped to an existing pump station located adjacent to the south boundary of the existing landfill footprint. The leachate is pumped from this location along a forcemain which discharges to the collection system at Fifth Line and Old Goulais Bay Road. Five flushing stations and an air release valve are installed along the forcemain between the pumping station and Fifth Line to remove air and accumulated solids within the pipe. Leachate from the expanded landfill will continue to be conveyed to the City's wastewater treatment plant facility.

The capacity of the existing pumping station, forcemain and receiving sewage treatment plant shall be assessed prior to the submission of an ECA application.

6.6.4 Surface Water Management

The overall objective of the surface water management plan is to ensure that any drainage leaving the site does not adversely affect surface water in the vicinity of the site and that the site is in compliance with environmental regulations. As such, the site has been designed to keep uncontaminated surface water out of the disposal footprint. Currently, the majority of surface water infiltrates and becomes groundwater due to the permeable nature of the native soils, and the absence of on-site watercourses.

A further objective is to maintain the existing drainage conditions under which the majority of surface water infiltrates to groundwater.

The surface water management plan consists of several components, which collectively will achieve the objectives.

Separation of Surface Drainage System from Leachate

Clean surface water, originating from areas separate from landfill operations (i.e., outside the landfill perimeter road and perimeter ditches) will not be managed and will continue to drain unaltered.

Non-contaminated stormwater, originating from non-operating areas of the landfill (i.e., undeveloped areas or areas completed with final cover) will be collected in a ditch inside the perimeter road and conveyed to one of the three (3) stormwater management (SWM) ponds that will serve the existing and proposed landfill. The internal ditching will be designed to accommodate the peak flow generated from the 25-year design storm. Berms or ditching will be used to divert any non-contaminated stormwater away from landfill excavations where it may cause operational problems and from operating areas where it may come in contact with waste. Consideration of the potential impacts of climate change (e.g. more frequent or severe storm events) will be incorporated into detailed design as appropriate.

Potentially contaminated stormwater, such as that originating from operating areas where drainage may come in contact with waste or leachate, will not be discharged to the surface drainage system. This isolation of drainage from operating areas will be accomplished by grading of waste and daily/intermediate cover surfaces (i.e. interim separation berms, slopes and diversion ditches will be constructed as part of the landfill operations). All drainage from operating areas that may come in contact with waste or leachate will be collected and managed as leachate, i.e. allow infiltration within the active waste filling areas.

Infiltration of Surface Water

To compensate (to the extent possible) for surface water overland flow loss and groundwater recharge loss that will occur over the lined area of the landfill, infiltration of surface water will be encouraged at the landfill site. Non-contaminated stormwater from non-operating areas will be conveyed to the proposed stormwater management ponds and subsequently discharged to the Root River/Canon Creek.

Stormwater Management Ponds

Four (4) SWM ponds are proposed, to mitigate runoff impacts. Three (3) SWM ponds will serve the landfill; and the fourth, the South SWM Pond will serve the public drop-off, administration building, recycling centre, and adjacent paved areas.

The SWM ponds serving the landfill will have sufficient storage capacity to accommodate runoff from the 1:100 Year storm event for operation under emergency leachate spill conditions. Such emergency control is not required for the South SWM Pond.

The proposed SWM ponds will have no quantity control function, i.e., they will be operated with the valves in the open position. In cases where the monitored water quality exceeds the trigger parameters (e.g. Oil and Grease, Conductivity, pH and TDS) at two successive sampling events, the valve at the respective SWM pond that exceeded the trigger parameters should be closed and operated in contingency (batch) mode. The contaminated runoff will be treated and discharged to the receiving watercourse or pumped/hauled for treatment. The SWM pond valve can be operated in normally open condition again once the water quality falls below the trigger concentrations for two consecutive sampling events.

All SWM ponds will be designed to operate as water quality control facilities as identified in the City's SWM Guidelines (RV Anderson 2014) and will achieve MOECC Level 1 criteria (80% TSS removal). The SWM Ponds will be lined as a contingency in the event that the water quality exceeds the trigger parameters.

6.6.5 Landfill Gas Management

Landfill gas (LFG) is generated during the decomposition of organic material under anaerobic conditions. The rate of LFG production depends on the interrelationship of many factors of which, waste composition and age, temperature, moisture content, pH, and quantity and quality of nutrients and microbial populations are the principal factors.

The current landfill gas collection system includes:

- 41 vertical LFG extraction wells which are equipped with valves, to permit the adjustment of the well flow rates, and monitoring ports designed to allow the measurement of gas composition. The extraction wells are located throughout the eastern portion of the existing landfill footprint.

- Various header pipes and lateral pipes.
- One (1) enclosed flare with a temperature control system and landfill gas burner which is designed to handle a LFG flow of 770 standard cubic feet per minute (scfm) which is equivalent to 0.36 m^3/s. The flare is equipped with a centrifugal blower which provides the flexibility of adjusting flow rates.

The air quality impact assessment for the landfill expansion predicts that the maximum air quality concentrations are below the Ministry's and Canadian Council Ministers of the Environment (CCME) air quality criteria. Therefore, the proposed LFG collection system layout represents an extension of the existing landfill gas management system. The existing flare and blower are likely adequate to satisfy the landfill gas management requirements for the existing and expansion areas. The need for future flare upgrades will be monitored.

The current landfill has a gas collection and flaring system. The gas collection system for the proposed expansion will be expanded to provide full coverage as explained above. This system reduces a significant amount of greenhouse gases.

A landfill gas to energy feasibility study was completed in October 2011 for the site. Electricity generation and sale to the grid was recommended if long-term revenue incentives are secured. The City may consider the installation and operation of a landfill gas powered power plant in the future.

6.6.6 Odour Control

Landfill odours may originate from the waste (at the working face), landfill gas, leachate or waste reclamation activities.

Refuse odour is generated by recently disposed waste or waste excavation in the mining cell area and is controllable by various mitigation measures. Wastes with very strong odours will be placed at the toe of the working face and will be immediately covered with other waste or daily cover. The proper application of cover material at the close of the day will aid in controlling odour. If required, odour suppressing agents will be used as an additional measure to control waste odours.

Landfill gas odour is generated during the anaerobic decomposition of organic waste material. Landfill gas may be released at cracks or fissures in the cover soils long after landfilling has taken place. Depending on weather conditions, these may create an odour problem if landfill gases are being released in sufficient quantities. Regular inspections can identify cracks or fissures that must be repaired by filling with cover soil. The existing landfill gas management system helps to reduce landfill gas odours by extracting the gas and burning in a flare. The gas management system shall be systematically expanded as cells are filled to capacity (final contours).

If landfill gas odours become problematic, a number of measures can be taken, including the following:

- Identification and elimination of any potential source of odour;
- Placement of additional cover material;
- Repair fissures in the final cover;
- Application of de-odourizers; and
- Expand the landfill gas collection system.

Odour problems from leachate can occur where it is exposed to the atmosphere in manholes and pump stations. Leachate may also be exposed to the atmosphere if leachate seeps develop. Leachate will be collected and discharged to the sanitary sewer system by means of a forcemain. Any leachate seeps will be promptly repaired.

As noted previously an odour management plan specific to landfill mining will be prepared.

6.6.7 Litter Control

Security of loads is a matter of public safety and is mandated through the Ontario Highway Traffic Act. Regulation 363/04 "Security of Loads" adopts Canada's *National Safety Code* 10 Cargo Securement published by the Canadian Council of Motor Transport Administrators (CCMTA). The standard is based on consultations with all provinces, territories and Transport Canada. Motor vehicle operators must ensure loads do not fall or become dislodged from their vehicle.

Given the nature of landfilling operations, as well as waste mining activities, litter control is however needed within and adjacent to the site. Several measures can be taken to minimize the amount of wind-blown debris leaving the active disposal area of the Landfill. Control measures can be divided into two groups: preventative measures to limit the generation of litter and regular maintenance measures to collect and prevent litter from leaving the site. Litter inspections will be carried out around the perimeter of the site on a monthly basis.

The following preventative actions will be taken to control and minimize the amount of litter generated at the Site:

- All vehicular traffic transporting waste to and around the Site will have loads secured to prevent waste from becoming dislodged or blowing out of the vehicle;
- Daily cover soils will be placed over the working face of the landfill in order to minimize the blowing of debris;
- Waste will be compacted to reduce blowing litter;
- The active face of the landfill and waste reclamation areas will be kept to a minimum, especially on windy days. This may be accomplished by placing daily

cover soils over a portions of the active face, should windy conditions warrant this action; and
- Portable litter control fences will be utilized at the active face of the landfill, if required, to prevent wind-blown litter from leaving the active disposal area. Temporary (i.e., snow fences) or permanent litter control fences may also be used around the perimeter of the landfill, if required.

Under normal operating conditions and with the implementation of the above control measures it is still expected that some litter will be blown from the active landfill area. The landfill operator will carry out monthly inspections around the perimeter of the site. Any wind-blown litter observed during the inspections will be collected through both manual and mechanical methods and returned to the active landfill area.

6.6.8 Dust Control

Dust generation is common at most landfill sites due to the handling of soils and the movement of vehicles along gravel and dirt roads. Dust impacts result from: landfill site traffic, landfill operation, waste excavation and screening, soil borrow operation, and wind erosion. Dust in the vicinity of a landfill site should not be problematic under normal conditions and is usually controllable.

To ensure dust does not become a problem at the site during normal or extremely dry and windy conditions, the following control measures will be implemented:

- the extent of the waste reclamation area and soil handling operations will be minimized during high wind conditions;
- vegetation will be established on inactive areas, if required, to minimize wind erosion; and
- if dry conditions warrant, a dust suppressant will be applied to the on-site roadways and soil borrow areas, and active disposal area.

6.6.9 Noise Control

Potential noise impacts from the site may result from operation of the landfill equipment and/or waste reclamation operation equipment. The operation of this equipment will be conducted in such a manner as to minimize noise impacts, whenever possible. In order to reduce the noise impacts to surrounding residents, operation of landfill equipment will not be undertaken prior to 1 hour before and no later than 2 hours after the approved hours of operation.

All operation equipment used during landfill construction, landfill operation and waste reclamation activities will comply with the noise level limits outlined in the "Noise Guidelines for Landfill Sites" (MOECC, 1997). In addition, a landfill equipment maintenance program will be implemented at the site with particular attention to

maintaining and where feasible, improving the noise muffling systems on landfill equipment.

The Noise Impact Assessment prepared by Dillon for the proposed expansion recommends the construction of a 2.5 m high, 150 m long soil berm to mitigate noise from the proposed leaf and yard waste composting facility. The proposed noise mitigation berm should be constructed before the operations of the proposed leaf and yard waste composting facility starts.

6.6.10 Vector Control

The terms vector and vermin refer to objectionable insects, rodents, birds and other animals that may establish a habitat at a landfill. Common landfill vector and vermin include flies, rats, gulls and bears. The presence of animals at landfill sites is of concern because they represent potential pathways for the dissemination of disease to humans and domestic animals. Animals that can harbour or carry pathogens that may cause disease are collectively known as vectors. Disease may be transmitted by vectors through direct or indirect contact with humans.

Animals may be attracted to a landfill because site features offer suitable foraging habitat. Consequently, they may move onto the landfill temporarily or permanently. Secondly, animals may arrive at a landfill by chance as part of refuse delivered to the site. Because the working face is compacted and covered daily, rodents and insects do not survive and do not typically create problems.

Bears are expected to be present on-site. Daily, intermediate and final cover should minimize the attraction to bears. If bears become a problem, an electrical fence may be installed around the active working face and energized during the active bear season.

6.6.11 Fire Control

Accidental fires at landfills are rare. They are caused by two processes. The more common is a surface fire caused by undetected hot loads that are landfilled. Hot loads (i.e., loads that are smoking or visibly burning) may arrive at the site. Staff will monitor all vehicle arrivals for signs of a hot load. In the event that a hot load arrives on-site, the driver will be directed to an isolated area of the landfill to prevent a fire at the working face. The vehicle will then be unloaded and the fire smothered with soil.

Much less common is a subsurface fire resulting from the spontaneous combustion of wastes, usually caused by inappropriate operation of a landfill gas collection system drawing air into the landfill.

A fire plan has been developed by the City and staff will be trained regarding its contents. The following measures are in place at the landfill to either reduce the potential for fires, or to react to fires in the event they occur:

- No smoking is permitted in the landfill;
- A stockpile of clean fill material is maintained adjacent to the working face for smothering any accidental fire;
- Burning of waste is prohibited at the site; and
- Suitable fire extinguishers are kept and maintained in working order in all structures and landfill vehicles and equipment.

Site staff will be trained in the prevention and detection of fires along with the procedures to be followed in case of fires. Fire Services will be called to investigate and respond to fires other than small incidental fires brought under control by the landfill staff.

6.7 Site Development and Operation

Initial Site Preparation

Before wastes are received at the expanded landfill, the following activities will be undertaken:

- Relocate the existing compost pad and earth borrow area located north of the existing Landfill;
- Implement sediment control plan;
- Clear and grub the initial areas of construction (Cell 1);
- Strip topsoil from Cell 1 and other initial construction areas that will be regraded;
- Strip existing final cover for the overlap areas;
- Excavate and grade Cell 1 to proposed base contours;
- Construct berms to divert any surface water from the cell excavation area, and away from the lined area of Cell 1;
- Construct the liner and leachate collection system for Cell 1;
- Construct a new stormwater management pond and perimeter ditches;
- Construct the leachate pump station and leachate forcemain extension and connection;
- Construct initial perimeter road extension;
- Establish new groundwater and gas monitoring stations; and
- Initiate disposal activities in Cell No. 1.

The City will ensure all the nuisance control measures are in place to minimize any environmental impacts during landfill construction, mining and operation activities.

Development Sequence

The proposed landfill expansion consists of seven cell areas (Cells 1 to Cell 7) and one landfill mining area (Cell 1A) as shown on **Figure 6.1.** The Cell Development Staging assumes cells will be constructed from Cell 1 through to Cell 7. Waste reclamation will commence at Cell 1A following completion of Cell 1, 2 or 3.

Hours of Operation

The maximum proposed hours of operation for the expanded landfill are Monday to Saturday, 7:30 am to 5pm, except for statutory holidays. The landfill management may decide to increase or decrease the hours of operations anytime within the maximum proposed hours of operation.

Landfill equipment may start internal operations one hour earlier or later to prepare or close the daily operations respectively.

Site Equipment

Basic functions to be performed by landfill equipment are:

- Waste grading and compaction; and
- Excavating and placing of daily and intermediate cover.

Typically, these functions will be performed by a landfill compactor, dozer and loader. A rock truck will be used to haul soil to the active area.

Other functions requiring equipment are landfill cell preparation, final cover construction, delivery of drop-off bin wastes to the working face, road maintenance, snow removal, litter pickup (tow behind vacuum) and dust control. Some of these functions may be performed with on-site equipment, but others may require equipment to be leased or a contractor to be hired.

Routine maintenance and cleaning will be performed as necessary to keep on-site equipment in good operating order.

Landfill Staff

Operations will be undertaken by City staff but may be contracted to a third party in the future. All employees working at the landfill will be properly trained for the jobs that they will be expected to perform. The following gives a brief description of the staff at the landfill:

- Landfill Site Management - The Landfill Management staff are responsible for the operation of the Landfill. They oversee and co-ordinate day-to-day operations at the site.
- Equipment Operators and Labourers - Under the direction of the Landfill Management staff, the Equipment Operators and Labourers are responsible for operating and maintaining mobile equipment used for waste handling and disposal operations, site maintenance and housekeeping and other assigned work tasks.
- Administrative Personnel - administrative personnel will be employed at the landfill to conduct work as directed by Management staff.

Continuing on-the-job training will be provided for all employees. The training will emphasize the safe and environmentally sound operation of the landfill. All employees will be given safety training covering all equipment and systems with which they will be expected to interact on a daily basis.

Final Cover

A progressive final cover placement program will be utilized throughout development of the site in order to maximize surface water runoff, thereby reducing the amount of infiltration into the landfill area and consequently minimizing leachate generation. Final cover will be progressively placed over all areas of the landfill that have reached final contours. The final cover will be constructed with a 0.85 m soil layer overlain by a 0.15 m layer of soil capable of sustaining vegetation.

Environmental Monitoring (Public Liaison) Committee

An Environmental Monitoring Committee exists for the Sault Ste. Marie Landfill. This committee has been kept aware of the proposed expansion throughout the EA process. It is anticipated that the committee will continue to be active into the future and will serve as the focal point for dissemination, review and exchange of information and monitoring results relevant to the Site. Any changes to committee membership will follow an open transparent application process.

Site Closure and Post-Closure Care

During landfill development, final cover and seeding will be applied progressively to portions of the fill area that are completed. Consequently, site closure will involve reaching final waste elevations over the last remaining area of the landfill followed by the application and seeding of final cover in that area. The entrance gate will be retained to control access.

Long-term maintenance will be concerned primarily with maintenance of the final cover and leachate management systems. Erosion, ponding from settlement, and leachate seeps will be corrected, as required. Typically, regular inspection and monitoring takes place for a period of two years after site closure, after which a long-term monitoring and care program is established.

A Closure Plan will be submitted to the Regional Director of the MOECC for approval when the landfill site is five years from its projected completion.

7.0 POTENTIAL NET EFFECTS

This chapter of the Environmental Assessment describes the potential for net effects (i.e. effects remaining after mitigation) to occur as a result of the proposed landfill expansion (including landfill mining). Potential effects have been described for each of the following:

- Natural Environment (biology, hydrogeology and surface water);
- Atmospheric (air quality, odour and noise);
- Socio-Cultural Environment (archaeological, social land use, visual, atmospheric (i.e noise, dust, odour); and
- Economic Environment (business, transportation).

The assessment of potential net effects was based on the landfill conceptual design as noted in section 6.0 of this report. As such it was assumed that a section of the existing fill area would be mined and lined and the new fill area lined to reduce the potential for groundwater impacts. Summaries of potential effects are included in the subsections below. Technical discipline specific reports are included in appendices to this EA (**Appendix D to N**).

Mitigation measures were recommended to reduce or eliminate potential effects on the environment. The recommended mitigation measures are discussed in the following subsections and included in the impact management plan for the site (see Section 8.0 of this report).

For this expansion, the access route was considered to be along Fifth Line from Highway 17 to the site as this represents the route for the majority of trucks coming to the landfill. It is noted that this route has not changed from the current access route to the site.

7.1 Approach to the Assessment of Net Effects

The assessment of net effects was completed using criteria initially documented in the EA Terms of Reference. **Table 7.1** presents the evaluation criteria used for the effects assessment and notes the rationale for any changes to the criteria included in the Terms of Reference.

The study areas used for the assessment of effects were determined by the technical disciplines and represent the area with the greatest potential for impact from the proposed expansion activities. The study areas considered are also noted in Table 7.1.

Table 7.1
ENVIRONMENTAL COMPONENTS TO BE CONSIDERED IN EVALUATIONS (TABLE 5.1 IN EA TERMS OF REFERENCE)

Criteria From EA Terms of Reference		Rationale for Changes to Criteria	Study Area Used in EA
Environmental Component	**Indicators**		
Natural Environment			
Biology	• Terrestrial systems on site, off site and in the vicinity of the current or potential site. • Aquatic habitat and fisheries on site, off site and in the vicinity of the current or potential site. • Presence of wildlife on site, off site and in the vicinity of the current or potential site. • Presence of medicinal plants on site.	No substantive change from assessment criteria proposed in Terms of Reference.	• On-site – within the existing and proposed expanded fill area. • Site vicinity - within 1 km of the on-site study area.
Geology/Hydrogeology	• Geologic conditions. • Groundwater flow and quality. • Geological/hydrogeological complexity. • Wellhead protection areas of municipal supply wells. • Groundwater use (private and municipal). • Development of future water resources.	No substantive change from assessment criteria proposed in Terms of Reference. Geologic conditions and geological/hydrogeological complexity were considered in the assessment but not included as separate assessment criteria.	• On-site - within the existing and proposed expanded fill area.
Surface Water	• Watersheds. • Drainage paths. • Surface water flows and quality.	No substantive change from assessment criteria proposed in Terms of Reference. Watersheds and drainage paths were considered in the assessment but not included as separate assessment criteria.	• On-site - within the existing and proposed expanded fill area.
Socio-Cultural Environment			
Archaeology	• Presence of known or potential archaeological resources on site.	No substantive change from assessment criteria proposed in Terms of Reference.	• On-site - within the property boundary.
Heritage	• Presence of known heritage landscapes on site.	There are no significant heritage landscapes on the site and the view from the road will not significantly change.	• Not applicable

Table 7.1
ENVIRONMENTAL COMPONENTS TO BE CONSIDERED IN EVALUATIONS (TABLE 5.1 IN EA TERMS OF REFERENCE)

Criteria From EA Terms of Reference		Rationale for Changes to Criteria	Study Area Used in EA
Environmental Component	**Indicators**		
Social	• Presence of existing residences on site, off site in the vicinity of the current or potential site and along the access route(s). • Presence of institutional, community and recreational features on the site, off site, in the vicinity of the current or potential site and along the access route(s). • Presence of First Nations reserves and communities and spiritual, cultural or ceremonial and traditional use sites. • Community characteristics. • Community concerns.	No substantive change from assessment criteria proposed in Terms of Reference. Information on community concerns was collected and used to inform the assessment of potential for displacement and disruption effects on residents and community features. This was not considered as separate criteria.	• Site vicinity - within 1km and 2 kms from the existing and proposed expanded landfill fill area.
Planned Land Use	• Official Plan designations and zoning on site, off site and in the site vicinity. • Future development proposed in the site vicinity and along the access route(s).	No substantive change from assessment criteria proposed in Terms of Reference.	• On-site - within the existing and proposed expanded fill area. • Site vicinity - within 500 metres of the on-site study area • Regional – within 1 km of the site vicinity study area
Visual	• Existing views/viewsheds of the facility in the site vicinity.	No substantive change from assessment criteria proposed in Terms of Reference.	• On-Site - within the existing and proposed expanded fill area; • Site-Vicinity - within 500 metres of the on-site study area; and, • Regional - the lands within 1.5 kms.

Table 7.1
ENVIRONMENTAL COMPONENTS TO BE CONSIDERED IN EVALUATIONS (TABLE 5.1 IN EA TERMS OF REFERENCE)

Criteria From EA Terms of Reference		Rationale for Changes to Criteria	Study Area Used in EA
Environmental Component	**Indicators**		
Atmospheric Dust Noise Air Quality	• Ambient (baseline) dust conditions. • Ambient (baseline) noise conditions. • Ambient (baseline) air quality conditions.	No substantive change from assessment criteria proposed in Terms of Reference.	• Air quality study area is based on potential area of influence. • Noise study area is based on nearest receptors.
Economic			
Agriculture/Forestry/Mining	• Presence of or potential for agricultural/forestry and mining activity on site, off site, in the vicinity of the current or potential.	There is no agriculture or forestry in the site vicinity. Mining (i.e. aggregate extraction) was considered under the Businesses Environmental Component.	• Not applicable
Businesses	• Presence of business enterprises on site, off site, in the vicinity of the current or potential site and along the access route(s).	No substantive change from assessment criteria proposed in Terms of Reference.	• Site vicinity - within 2 km from the existing and proposed expanded fill area.
Transportation	• ~~Proximity of the site to airports~~. • Traffic safety along access route(s). • Traffic operations along access route(s).	No substantive change from assessment criteria proposed in Terms of Reference. The criterion "proximity of the site to airports" was removed as there are no airports in the vicinity of the landfill.	• On-site - within the existing and proposed expanded fill area. • Site vicinity – along Fifth Line to Old Goulais Bay Road to the west and Highway 17 to the east.
~~Tourism~~	~~• Presence of tourist enterprises on site, off site, in the vicinity of the current or potential site and along the access route(s).~~	Tourism facilities were captured under Businesses and thus removed as a separate criterion.	• Not applicable

7.2 Natural Environment Effects

The following describes the natural environment impact assessment completed for the preferred expansion option. Full details are provided in **Appendices D to F**.

7.2.1 Biology

Data Collection:
Field assessment of the proposed expansion area was undertaken in September 2011. Information collected during this field visit was supplemented with data available from past field work undertaken over a number of years prior to this point. The field work provided site specific information to supplement the background data collection undertaken for the site. When in the field staff conducted a vegetation inventory, completed an ecological land classification, conducted an aquatic assessment, and documented wildlife observations.

The off-site study area for this work included areas within 100 m of the preferred option boundary. It is generally assumed that the natural features that most commonly occurred in this region of Ontario would not be impacted by proposed expansion works if they were located outside of this 100 m setback.

Existing Conditions:
The following outline the existing conditions observed during the field work.

Vegetation Inventory - A total of 76 plant species were documented during terrestrial field studies. Just over half of the species found were identified as native species and just under half as introduced species. All of the native plant species observed are considered to relatively common (more than 100 occurrences in the province). Based on the species found it was determined that the natural vegetation communities adjacent to the current landfill have undergone previous disturbance. A number of non-native and potentially invasive species were observed during site investigations, mainly associated with the regularly disturbed areas in the landfill.

Ecological Land Classification - A total of seven natural and/or naturalized ecological communities and one cultural (human influenced) land use were observed within the study area. All vegetation communities surveyed are considered common in Ontario and no rare vegetation community types were observed.

Incidental Wildlife Observations – Thirteen wildlife species were observed in the study area during the field work including: American Crow, Bald Eagle, Black-Capped Chickadee, Common Raven, Mourning Dove, Ring-Billed Gull, Song Sparrow, Turkey Vulture, White-Crowned Sparrow, Red Squirrel, Black Bear, Spring Peeper, and Mourning Cloak. With the exception of Bald Eagle, which is listed as Special Concern under Ontario's Endangered Species Act (ESA), 2007, all of the species listed are considered common and secure in Ontario.

Aquatic Assessment - Ministry of Natural Resources (MNR) historical fish collection data, as well as incidental observations made during sampling events, indicate that the Root River and lower sections of Canon Creek can support a diverse fish community, including salmonid species. During the sampling events, salmonid migration and individual fry were observed. The Root River was identified as sensitive cold-water fish habitat (e.g., brook trout, rainbow trout), while Canon Creek is warm-water fish habitat (e.g., blacknose dace, brook stickleback and creek chub), with the occasional coldwater species present.

Species at Risk and Species of Conservation Concern - Through a search of available historical occurrence records within 3 km of the landfill from the MNR and various wildlife atlases, it was determined that 27 Species at Risk (SAR) and Species of Conservation Concern (SCC) have the potential to occur in the general geographic vicinity of the study area.

One SCC, a Bald Eagle, was observed in the Study Area during fieldwork but no nests were observed in area. The Root River adjacent to the landfill may provide seasonal foraging habitat. However, existing site noise disturbance may preclude nesting in proximity to the landfill.

Candidate Significant Wildlife Habitat - The MNR has developed a set of criteria by which Significant Wildlife Habitat can be identified in Ontario. Based on site characteristics observed during field work, four Candidate Significant Wildlife Habitats were identified in the study area. Most habitats were assessed to have a low potential of occurrence in the study area. Woodland raptor nesting habitat had a moderate potential due to the presence of woodlands and viable nesting trees; although, no raptor nests were observed in the immediate vicinity of the study area. Further, existing site noise disturbance may preclude nesting in proximity to the landfill. Therefore, it is unlikely that this potential habitat is present.

Potential Effects and Mitigation: Typically, the adverse effects from landfill expansion on vegetation and wildlife are most evident during the site preparation and construction phase of a development with some potential for removal resulting from landfill construction or disturbance resulting from noise during operation. While there is some removal of vegetation required, it is expected that the proposed expansion will lead to a minimal residual effect on local wildlife habitat. The potential for direct and indirect impacts as a result of landfill are summarized in **Table 7.2**.

Environmental monitoring during each landfill expansion phase will consist of monitoring the erosion and sediment control measures, tree protection fencing, and the edges of protected natural features. Periodic environmental monitoring is recommended to be carried out through the duration of construction activities to ensure that the erosion and sediment control measures described above operate effectively and to monitor the potential impacts to natural features. The duration of construction is defined as the period of time from the beginning of site preparation (e.g., vegetation clearing and grubbing) and earthworks until the site is stabilized. Site stabilization is defined as the

point in time when expansion works have been completed, the associated infrastructure installed and exposed soil has been stabilized.

Protected vegetation areas will require periodic monitoring to ensure that they are not impacted by the adjacent development landfill expansion. Should impacts be observed, necessary steps will be taken to ensure that the impacted vegetation is either restored or replaced.

Environmental monitoring will be initiated during operations to track potential effects on local groundwater and surface water systems and their associated aquatic habitat. Environmental monitoring activities during operations will also include monitoring of invasive species encroachment, invasive species control (if necessary) and woodland edges.

Table 7.2
BIOLOGY SUMMARY OF NET EFFECTS

Criteria	Potential Effect	Proposed Mitigation	Net Effect
Terrestrial systems on site, off site and in the vicinity of the current or potential site.	The expansion of the Sault Ste. Marie Landfill will require the removal of trees and ground vegetation (approximately 13 ha). Forest fragmentation on a landscape level scale is not anticipated as alternative movement corridors exist in the general area of the landfill. Tree removal may result in the following impacts on a site level: • Loss of woodland and meadow vegetation. • Loss of woodland and meadow habitat potentially used by wildlife common to this area. • Narrowing of the ecological linkage west of the landfill. • Physical injury, root damage, and compaction of trees not intended for removal that may result from construction activity.	Minimize need for tree removal to the extent possible. General tree protection and edge management practices are recommended to minimize the physical disturbance associated with vegetation removal. These include: • Remove and dispose of waste pile and inorganic debris. • Use qualified professional for tree removal. • Trees located along new woodland edge that may conflict with construction activity should be pruned by a qualified professional. • Where feasible, select felled logs and other organic debris should be placed carefully in existing forest. • Small trees, shrubs and ground vegetation immediately adjacent to clearing area should be preserved. • Tree protection fencing should be installed around critical root zone of preserved trees. The fencing should be monitored and maintained throughout construction. • Heavy machinery should be avoided within the root zones of the adjacent trees to prevent soil compaction and root damage. • Avoid placing fill in periods of high run-off (e.g. spring and fall) to prevent deposition of sediment in tree root zones. • If excavation is required near the forest edge, an arborist should expose the root system to determine where root pruning is required. • Use of core aerators should be considered where appropriate to improve aeration and	Minor net effects anticipated resulting from vegetation removal.

Table 7.2
BIOLOGY SUMMARY OF NET EFFECTS

Criteria	Potential Effect	Proposed Mitigation	Net Effect
		drainage of compact soils near forest edge. • Woodland edge should be inspected periodically during construction for indicators of tree dieback. If observed a condition assessment should be completed by a qualified arborist. • Within 12 months of each stage of landfill expansion, a qualified arborist should assess the new woodland edge and conduct removal or pruning as required.	
	Physical site disturbance may increase the likelihood that exotic and/or invasive flora species will be introduced to the surrounding vegetation communities.	• The potential impact of invasive species can be largely mitigated through the implementation of an edge management plan (see points above). • Select removal should occur in areas heavily invaded by invasive exotic species.	No net effects anticipated.
Aquatic habitat and fisheries on site, off site and in the vicinity of the current or potential site.	No direct aquatic effects anticipated as a result of erosion and sedimentation as there are vegetation buffers between the landfill expansion area and the Root River and Canon Creek. Potential for erosion and sedimentation effects will be limited to localized edge disturbance and/or loss of adjacent vegetation due to the deposition of dust and/or overland mobilization of soil.	Mitigation for erosion and sediment control includes: • Silt fencing or a reasonable alternative should be installed on the edge of the development limits and grading limits. • Mud Mat should be installed at the construction entrance. • Rock Check Dams and/or Filter Socks in swales and ditches. • Removal of any accumulated sediments. • Surface stabilization for stockpiles and temporary sediment basins. • Erosion control blankets may be required for sloped restoration areas regardless of timing.	No net effects anticipated.
	Potential release of leachate from the landfill could result in water quality effects. Landfill leachate could contain microorganisms and high concentrations of nutrients and other deleterious substances (e.g., organic carbon, nitrogen, chloride, iron, manganese, phenols,	• Employ operational best management practices to collect leachate. • Employ an operational stormwater management (SWM) plan.	No net effects anticipated.

Table 7.2
BIOLOGY SUMMARY OF NET EFFECTS

Criteria	Potential Effect	Proposed Mitigation	Net Effect
	pesticides, solvents, heavy metals, etc.) that could degrade groundwater and aquatic systems in surface water.		
Presence of wildlife on site, off site and in the vicinity of the current or potential site.	Potential for incidental wildlife mortality on-site primarily attributed to vehicle collisions. This is common when a construction project is located within or in proximity to potential wildlife habitat.	• Vegetation removal should not take place during established core breeding bird season (i.e. May 9th to August 8th). • Where appropriate retain non-hazardous wildlife habitat trees that contain net, den or roost cavities. • Avoid construction lay-down and staging within the boundary of a natural feature scheduled for preservation.	Minor net effects anticipated.
	Man-made disturbance to local wildlife communities within the off-site study area due to indirect impacts such as noise, light, vibration and human presence can adversely influence movement, population size and breeding success of local wildlife. Local wildlife is likely habituated due to the existing operational activity on the site. The disturbance is expected to be most pronounced during the site preparation (vegetation removal) phase of the expansion. Localized ecological connectivity west of the site may be affected by removal of vegetation cover, subsequent narrowing of the ecological linkage and the disturbances mentioned above associated with operations.	• Where possible maximize the distance of construction equipment from the woodland edge. • Limit the use of lighting where possible. • Advise contractor and construction staff through drawing specifications and awareness training to visually monitor wildlife species and report encounters.	No net effects anticipated.
Presence of medicinal plants	Plant species were inventoried. The City has not been made aware of any First Nations medicinal plants on-site through the consultation process.	Continue to reach out to Aboriginal Communities as the project continues to move forward and incorporate mitigation as necessary.	No net effects anticipated.

7.2.2 Hydrogeology

Data Collection:
The assessment of potential hydrogeological effects associated with the proposed expansion was based on secondary source information, a site specific hydrogeological assessment and annual monitoring data collected over the last 35 years. The study area for the hydrogeological impact assessment is the area within the landfill property owned by the City of Sault Ste. Marie. Consideration was also given to the immediate vicinity and the regional context. The contaminant model POLLUTE was used to assess potential impacts on groundwater.

Existing Conditions:
Geology - The physiography of Sault Ste. Marie is heavily influenced by both the topography of the bedrock surface and the nature and thickness of the overburden which consists of Quaternary sediments of the most recent Wisconsinan glaciation.

An Archean upland known as the Gros Cap Highland that has rock knob topography occurs in the northern part of the city. The upland bedrock consists of intrusive gneissic granitoid rock which has very thin overburden. South of the exposed bedrock ridges, most of the city is located in a lowland area underlain by Proterozoic bedrock chiefly the red sandstone of the Jacobsville Formation. The Proterozoic bedrock is overlain by thick overburden comprised of glacial and postglacial sediment. A major northeast-trending fault, referred to as the Anderson Fault separates the Jacobsville Formation from the Archean rock to the north (Cowan et al., 1998).

The landfill site occurs immediately south of the bedrock ridge in an area of sand and gravel which was deposited by meltwaters flowing south from glacier ice on the Gros Cap Highland. These deposits are associated with the main Glacial Lake Algonquin shoreline. Underlying the sand and gravel and extending further south from the landfill, fine and medium sand was deposited in a nearshore or deltaic environment. Further south from the sand deposits, deep fine-grained clay was deposited in a deep water environment.

The landfill site is developed on the northern limit of a stratified glaciolacustrine beach type deposit which is underlain by deltaic sands and gravels. Maximum overburden thickness approaches 36 m below the existing landfill. Alluvial sands and gravels border Canon Creek and the Root River, and also form the flood plain of the abandoned meander area of the Root River located south of the fill area and north of Fifth Line. Monitoring wells located along the Root River, in the vicinity of Fifth Line, are placed in these alluvial deposits.

Hydrogeology - A large ground water recharge zone occurs at the southern extent of the Gros Cap Highland. The recharge area consists of sand and gravel beaches deposited adjacent to the uplands, and covers an area of 37.5 km² (SSMRSPA, 2011). The landfill site is situated in this recharge zone.

The municipally serviced area (i.e. potable water) extends to the landfill site (extends north along Old Goulais Bay Road and then east along the Fifth Line to the site). Water Well Records along Fifth Line in the vicinity of the landfill indicate that water wells are more than 40 m deep and are typically installed in sand.

On-site, a groundwater divide is located along the western portion of the existing fill area. Groundwater flows both southeast and southwest from this divide. The lateral direction of shallow groundwater flow, beneath the central and eastern portion of the landfill fill area, is south-southeastward with discharge to Canon Creek and the meander area. Intermediate flow, at approximately 10 m in depth in the area of the meander loop, continues southward with ultimate discharge estimated to be into the Root River south of the property boundary.

The till units of the meander area, and east of Canon Creek and the Root River have lower permeability than the sand. This causes preferential lateral flow in the overlying sands and gravels.

Groundwater flows both southwest and west from the groundwater flow divide through a massive, relatively undifferentiated sand deposit. The water table west of the existing fill area is significantly deeper (e.g., typically greater than 15 m) than the water table south and southeast of the existing landfill.

Source Water Protection - In March 2015, the Sault Ste. Marie Region Source Protection Plan (SPP) was approved and became effective July 1, 2015. The SPP was prepared to protect existing and future drinking water sources. The plan includes policies to manage land uses within vulnerable areas.

The existing landfill site and proposed expansion are not within a wellhead protection area as identified by the SPP. They do occupy a small portion of an area identified as a Medium Vulnerability Source Water Protection Area and Significant Groundwater Recharge (SGRA) area as identified on Map 11 of the SPP. The SPP recognizes municipal waste disposal sites as potential threats to sources of drinking water and identifies policy tools to address drinking water threats. As such the site is carefully managed. There is an extensive annual ground water quality monitoring program that has been completed since 1988 as required by the Environmental Compliance Approval and landfill site's annual monitoring reports are presented to Council, MOECC and the Environmental Monitoring Committee. For the landfill expansion, approval is required under the *Environmental Assessment Act* and *Environmental Protection Act*. Obtaining approval under these legislations will require demonstration that the expansion does not pose a threat to the aquifer and drinking water. It is also noted that the expansion as proposed provides an opportunity to implement enhanced leachate management for the western portion of the site.

Existing Site Monitoring - Extensive hydrogeological investigations were completed in the early 1980's as part of the expansion of the landfill at that time. A comprehensive monitoring program has been in place at the site since the mid-1980s and the monitoring well network has expanded through the years.

Potential Effects and Mitigation:

The conceptual design of the landfill expansion addresses mitigation of potential groundwater impacts from the proposed expansion fill area as well as the western portion of the existing fill area (i.e. the area west of the groundwater divide). The design for the expansion involves construction of engineered cells with a full underdrain leachate collection system and composite liner system.

The impact mitigation that currently occurs in the western portion of the site (purge wells and contaminant attenuation zone) will be removed and replaced with the proposed enhanced controls. The proposed expansion includes landfill mining in this area to accommodate a liner and leachate collection system as proposed for the new fill areas.

Groundwater impact control is well established and effective on the south and east sides of the existing fill area through a horizontal collection system which will continue to be maintained through the contaminating lifespan of the landfill. The horizontal collector system is located beyond the limit of the existing fill area and at a depth that allows for easy replacement, if necessary.

For the proposed expansion area, the evaluation of the potential for groundwater impacts was based on the following:

- Underlying soil characteristics;
- Leachate collection service life;
- Waste density per unit area; and
- Leachate generation rate.

Using this information, contaminant transport modelling was completed to estimate groundwater quality impacts resulting from the proposed expansion. The computer program POLLUTE was used to predict groundwater quality considering the performance of the leachate control system and the hydrogeological setting. The impact of the landfill on groundwater quality was assessed by comparing the predicted impact to the Ontario Drinking Water Objectives and Reasonable Use Guideline. **Table 7.3** presents the potential effects of the expansion and proposed mitigation for hydrogeology.

Table 7.3
HYDROGEOLOGY SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effects
Groundwater flow and quality.	Based on the anticipated leachate generation for the site and the contaminant transport model, the site is predicted to meet appropriate criteria and have minimal impacts during the service life of the engineered systems that have been incorporated into the design assuming proposed mitigation is put in place in the design.	The following mitigation is incorporated in the design: • Landfill mining of the western portion of the existing site and the addition of an engineered liner and leachate collection system for the new fill area. • New horizontal groundwater collection system on the western edge of the new fill area to be incorporated if necessary to address any potential impacts from the western portion of the existing fill area. • Continued operation of the existing horizontal collection system to maintain mitigation of impacts to the south and east of the site.	Anticipated improvement in overall groundwater protection.
Wellhead protection areas of municipal supply wells.	The proposed expansion is outside of the municipal wellhead protection zone.	No mitigation necessary	No net effects anticipated.
Groundwater use (private and municipal).	Some residents in the vicinity of the landfill have groundwater wells and some concern has been raised about the potential for impact to residential wells.	• The City will implement a residential well water monitoring program (see Section 8 for more details on this program). Should impacts be detected extension of the municipal water system could be completed or alternative water supplies provided. Municipal potable water is currently available along Fifth Line west of the landfill site.	No net effects anticipated.
Development of future water resources.	The existing landfill and proposed expansion is located in a Medium Vulnerability Source Water Protection Area and Significant Groundwater Recharge Area in the Sault Ste. Marie Region Source Water Protection Plan (SPP).	• The SPP requires the City to protect these areas through their Official Plan policies. The proposed expansion complies with these policies. • Work completed as part of this EA shows the site is predicted to meet appropriate criteria and have minimal impacts	No net effects anticipated.

Table 7.3
HYDROGEOLOGY SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effects
		assuming mitigation is incorporated into the design as noted above. • Approval under the *Environmental Assessment Act* and *Environmental Protection Act* will demonstrate that the expansion does not pose a threat to the aquifer and drinking water.	

7.2.3 Surface Water

Data Collection:

The evaluation of hydrological impacts from the proposed landfill expansion was completed using a Visual OTTHYMO (VO2) hydrology model. The use of this model is in keeping with the City's Stormwater Management Guidelines (Anderson 2014). Data on flows in Canon Creek and Root River was obtained from WSC gauge 02CA002 – Root River at Sault Ste. Marie which provides 43 years of observed flow data (1971-2013). Information gathered and input to the model included:

- Drainage area;
- Surface and soil type;
- Land use; and
- Channel hydraulics.

The surface water analyses were based on two key assumptions:

1. The general layout and drainage characteristics conform to the design concept presented in the Design and Operations Report;
2. The surface water drainage system collects runoff generated from uncontaminated areas; runoff which has come into contact with refuse, such as the working face or other possible sources of contamination, are collected by the leachate collection system and are disposed of via the sanitary sewer system for treatment.

Existing Conditions:

The existing landfill site and proposed landfill expansion area are adjacent to Canon Creek to the North and East and the Root River to the South-East. The entire Root River basin is oriented in a northwest to southeast direction and drains approximately 210 km^2. It is the largest watershed within the jurisdiction of the Sault Ste. Marie Region Conservation Authority (SSMRCA). The Root River flows in a south to southeast direction from the Goulais River through the City of Sault Ste. Marie and the Rankin Indian Reserve to its outlet into the St. Marys River near Little Lake George. There are four main tributaries within the basin, the Root River, the West Root River, Crystal Creek and Canon Creek.

Canon Creek is a major tributary of the Root River. It is oriented in a west to east direction and drains an area of approximately 23.3 km^2. In 2006, a small portion of Canon Creek was realigned by moving the most southern section of the creek east away from the landfill to facilitate the extension of the existing landfill leachate collection system within the old creek bed. Canon Creek joins the Root River approximately 400 m north of the southern property boundary of the existing landfill site. Downstream of the confluence of Canon Creek and Root River is an old meander area that is to the south of the landfill, and is frequently inundated with water during high flow periods.

Physiography and Surficial Deposits - The northern portion of the Root River basin (including a majority of the Canon Creek basin) is located within the Pre-Cambrian Shield. This area is characterized by hard, igneous intrusive bedrock with little or no overlying soils.

The southern portion of the basin consists of a series of ancient lake beaches and terraces left after the last period of glaciation. The soils in this portion of the basin consist of medium textured sands and gravels. These sands are underlain by glacial till, silts and clays.

In the area immediately upstream of the outlet of the Root River, the soil types change to lacustrine clays and silts, and glacial till. These soils characterize the area south of the shoreline of a glacial melt water lake.

The soils in the area of the proposed landfill expansion consist of a deep layer of medium to coarse sands and gravels over silt or clay.

Land Use – The lands in the upstream reaches of the Root River basin are primarily forested areas. The area in close proximity to the landfill site is generally sparsely developed with aggregate extraction, low density residential, and some commercial uses. Downstream of the landfill site the sparsely developed land use pattern persists in proximity to the Root River extending to the Rankin Indian Reserve.

Flow Characteristics – Water Survey of Canada (WSC) has maintained a gauging station on the Root River located near the western boundary of the Rankin Indian Reserve since 1971. Flow recorded at the gauge from this unregulated watershed can be regarded as representative of the entire study area.

Historical flows show that annual flood peaks typically occur in month of April, but, can also occur in the September – November period. The highest flow observed for the 1971 – 2013 period was 66.8 m^3/s on April 22, 1992. However, the peak flow in 2013 has been estimated at 76.4 m^3/s based on a recorded maximum daily flow of 59.7 m^3/s on September 10, 2013 and a peaking factor of 1.28. Low flows can be expected in July and August, but, can occur as late as September.

There is a lack of historical flooding within the reach that includes the proposed landfill expansion. This is largely due to the fact that there is only a limited amount of development between the proposed landfill site and the Rankin Indian Reserve.

Climate – Sault Ste. Marie is located in the western part of the Sudbury climatic region. The growing season is longer and the winters are warmer than most of northern Ontario.

Local climatic variations occur due to topography, altitude, and proximity to water.

Stormwater Management - There is currently no formal facility that provides SWM servicing for the existing landfill site, aside from the existing pit that collects water from the northeast portion of the site. Drainage ditches along the landfill perimeter intercept surface runoff and route stormwater from surrounding lands around the fill areas to one of the three outlets or the existing pit.

Figure 7.1 is a base map of the landfill site including the proposed expansion, showing the drainage network, outlets and contributing subareas. The proposed active landfill site (L1, L2, L3, L4) covers a total area of 50.4ha (out of 145 ha owned by the City) and straddles the drainage divide between the Canon Creek and the Root River watersheds. Surface drainage will be provided by drainage ditches adjacent to the landfill: 12.2 ha of the northern half of the landfill site drains to Canon Creek while 38.2 ha drains to the Root River via both the meander loop south of the existing landfill footprint and the drainage ditch along Fifth Line. Of the remaining drainage adjacent to the site that is not active landfill (E1, E2), 2.5 ha in the northeast will outlet to Canon Creek by a swale, adjacent to the north perimeter of the SWM Pond that conveys flow to the outfall swale at the SWP.

CANNON CREEK

NE SWM POND

E2 – 2.5ha

Expanded Landfill Footprint

L2 – 12.2ha

Existing Landfill Footprint

E1 – 11.4ha

L1 – 9.7ha

L3 – 18.7ha

FOREBAY

SE SWM POND

ROOT RIVER

Compost Pad Area 16472m

SW SWM POND

L4 – 9.8ha

Public Drop off

Recycling Center

Admin / Maintenance

SOUTH SWM POND

Entrance / Exit

Exit

DITCH

LEGEND

- CATCHMENT AREAS
- DITCH
- FLOODPLAIN (100 YEAR)
- OUTLET SWALE
- PAVEMENT

AECOM Canada Ltd.
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THE CORPORATION OF THE CITY OF SAULT STE. MARIE, ONTARIO
ENGINEERING DEPARTMENT

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Sault Ste. Marie Municipal Landfill Site

COMMISSIONER OF ENGINEERING & PLANNING
JERRY DOLCETTI

Figure
7.1

Potential Effects and Mitigation:
From a water quality perspective the proposed expansion could result in potential impacts due to accidental leachate seeps to the surface and/or increases in Total Suspended Solids (TSS) concentration due to runoff from the internal gravelled access roadways or site erosion.

On-site stormwater management (SWM) will be achieved through the existing/proposed system of ditches, culverts, and SWM ponds that have been designed to mitigate the impacts of stormwater runoff on water quality before discharge to Canon Creek or the Root River. The SWM criteria, as identified by the MOECC in Ontario Regulation 232/98 and related Landfill Standards Guidelines (1998), include ditches with a 1:25 year capacity and treatment for 80% TSS removal.

Three new SWM ponds will be designed with emergency flow control systems at their outlet, as a contingency. The SWM Pond can act as an emergency response cell where runoff can be stored in case of surface water contamination by leachate or onsite spills. There will be regular inflow monitoring of indicator parameters (possibly including Oil and Grease, Conductivity, pH and TDS) to trigger a shutdown response using either a control valve or gate. The ponds will be lined and designed to retain the complete runoff from the 1:100 year rainfall until appropriate treatment can be applied. The runoff will either be treated and discharged to the receiving watercourse or pumped and hauled for treatment elsewhere.

From a water quantity perspective, there are negligible impacts since peak flows from the site are significantly smaller than those of the receiving watercourse and the peak flow from the landfill does not coincide with peak flows in the receiving watercourses. There is no mitigation proposed for water quantity as the impact is insignificant.

The potential surface water effects, proposed mitigation measures, and net effects are summarized in **Table 7.4**.

Table 7.4
SURFACE WATER – SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Surface water flows and quality	Water quality impact from leachate or spills	• All stormwater will be directed to lined stormwater management (SWM) ponds. • Downstream surface water receivers will be monitored as per current practice.	No net effects anticipated
	Water quality impact from total suspended solids (TSS)	• The SWM ponds will be designed to remove TSS.	Minimal net effects anticipated
	Stormwater from the ponds has the potential to result in thermal impact to Root River which is a cold water fishery.	• The SWM pond outflow structure will be designed to have bottom draw characteristics. • Landscaping around the ponds will encourage shading.	Reduced impact anticipated
	Negligible potential for water quantity impacts since peak flows from the site are significantly smaller than the receiving watercourse and the peaks do not coincide.	• No specific mitigation proposed.	No net effects anticipated
	On-site drainage paths will be altered with the proposed landfill expansion.	• The proposed expansion areas will be drained by ditches adjacent to the internal roadway system to convey stormwater to the SWP ponds before discharge.	No net effects anticipated.

7.3 Socio-Cultural Environment Effects

The following describes the socio-cultural impact assessment completed for the preferred expansion option. Full details are provided in **Appendices H to M.**

7.3.1 Archaeology *Data Collection:*

The Stage 1 and 2 archaeological assessment carried out for the proposed expansion included an historical records review and appropriate fieldwork:

- Site files at the offices of the Archaeological Data Coordinator Ministry of Tourism, Culture and Sport (MTCS) and Woodland Heritage Services Limited site files were checked to determine if any prehistoric sites had been previously recorded and registered either in or near the study area.

- Stage 1 fieldwork included observation of the subject lands to confirm archaeological potential previously identified in Sault Ste. Marie Archaeological Master Plan (ASI, 2011). 100% of the subject property was examined during the Stage 1 fieldwork.
- Stage 2 test pitting was undertaken within areas that were confirmed as retaining archaeological potential through field observation. Stage 2 fieldwork was conducted October 7, 8, 21, and 22, 2013. Test pits were excavated at 5m intervals in areas where archaeological potential was confirmed to exist. The test pits were at least 30x30cm in size and extended down to where either disturbed soils or sterile soils were observed. Test pits were backfilled. All excavated materials were screened through 1/4" mesh. The weather conditions on those days were ideal for Stage 2 fieldwork and in no way impacted the ability to conduct fieldwork.

The study area for the archaeological assessment is the on-site area within the property boundary.

Existing Conditions:

People have been living in the study area since the time glaciers receded and the land could support plants and animals. There are no known or registered archaeological sites within 1km of the study area.

The subject property demonstrates the entire range of conditions: from undisturbed to completely disturbed. Additionally, areas along the Canon Creek were subject to extraordinary natural disturbance a month prior to fieldwork as a result of an extreme weather event which eroded a considerable portion of the river's shoreline.

The property sits astride the southern edge of the Gros Cap/Algoma highlands. South of Fifth Line, the terrain is relatively flat, clay-based and known locally as the Korah Uplands. The topography of the Gros Cap Highland is primarily controlled by the bedrock, which ranges in elevation from approximately 300 metres asl to over 370 metres asl. In the lowlands, the topography is influenced by the bedrock, but largely controlled by the overlying Quaternary deposits. The main bedrock feature influencing the topography of the lowlands is a large, broad upland (herein, the Great Northern Road upland), approximately 3.5 kilometres east-west by 6 kilometres north-south, with its main axis roughly aligned along the Great Northern Road. A second, smaller upland (herein, the Korah upland), approximately 2.75 kilometres east-west by 3.5 kilometres north-south, occurs along Leigh Bay Road north of Baseline Road. The crests of these upland ridges stand at approximately 240 metres asl and 180 metres asl, respectively. To the east and west of these ridges, the underlying bedrock falls away to elevations as low as about 50 metres asl, which is approximately 133 metres below the current elevation of the St. Marys River at 183 metres asl. (ASI 2011).

The glacial outwash plains and beaches of Glacial Lake Algonquin are thought to have been formed sometime around 11-10,500 years ago. Subsequent glacial events in the form of advances, uplift, lake discharges occurred creating numerous complicated beaches. With the filling of Lake Minong and the catastrophic outflows around 9,400 years ago, it is likely that significant portions of Sault Ste. Marie were flooded again.

It is important to note that the dynamic environment that existed at this time suggests that these various early post-glacial environments would not have been 'active' for long periods of time and lake levels would have risen/fallen on an annual basis. The nature of the topography in Sault Ste. Marie is such that a 1 metre vertical fall in water levels could have moved a shoreline several kilometres horizontally.

The existence of a late Palaeo Indian site at the southern end of Leigh's Bay Road (only 1 kilometre from the current shore of the St. Marys River) suggests that beaches further removed inland may not have been suitable for occupation.

The main Canon Creek flows through the subject property and a smaller creek joins the Canon Creek near the eastern side of the property. The Canon Creek (and the associated smaller creek) are not navigable where they cross the property and fall continuously over cobbles, bedrock and for much of the year (outside of spring melt) do not carry enough water to float a birch-bark canoe. Indeed a bark canoe would be damaged within minutes.

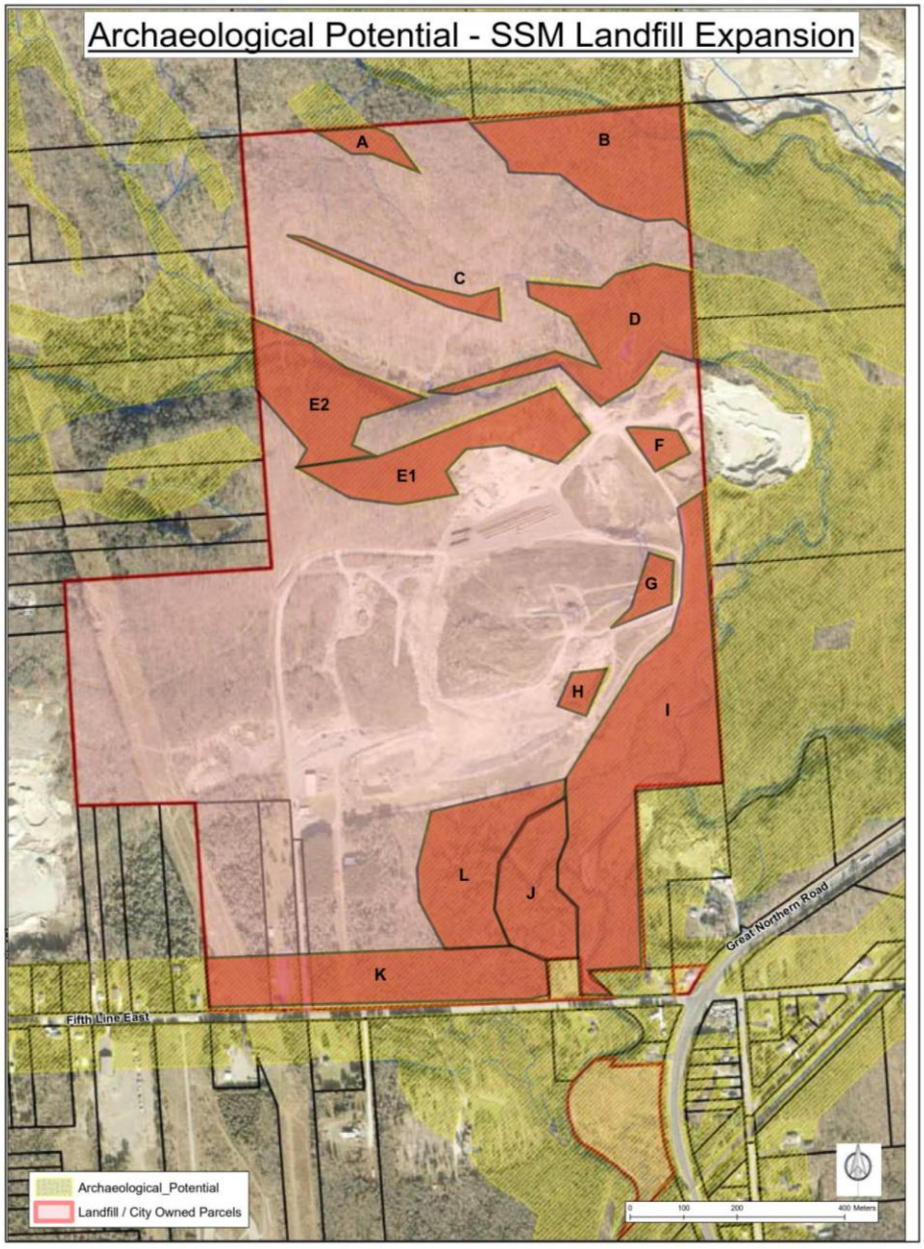
In terms of present day conditions, the property may be split into two parts: those areas north of the main Canon Creek and those areas south of the main Canon Creek.

North of Canon Creek, the terrain is wildly undulating with a topographic bedrock high. Vegetation is dominated by a variety of second growth communities of softwoods and hardwoods. The diameters of the trees suggest that the property was likely harvested in the 1950s and the remnants of several tertiary harvest roads are still in evidence. Push piles, stumps, abandoned/rusting vehicles attest to the previous uses of this area.

The area south of the Canon Creek is dominated by the City of Sault Ste. Marie Landfill. For the most part, this is an entirely disturbed area. What has not been excavated, leveled, developed for roads, buildings, or sewage infrastructure has been stripped of top soil and levelled again. In September 2013, an extreme weather event resulted in extreme erosion of the Canon Creek, primarily along the eastern extents of the property. From that point, the entire shoreline of the river (on both sides) was stripped of soil right down to bare rock for a distance of 30-50 metres back from the river.

The 2011 Archaeological Master Plan identified a number of areas as having potential. As a result of the Stage 2 assessment conducted for the proposed landfill expansion, suggestion was made to reclassify a number of these areas. The following summarizes the suggested reclassifications which are shown on **Figure 7.2**.

Figure 7.2 – Reclassification of Areas of Archaeological Potential



Archaeological Potential Area A - This area is more than 100m from the nearest permanent water source. It is expected that this area was identified as potential due to a 'GIS mapping artifact' and should be reclassified as not archaeological potential.

Archaeological Potential Area B - This area is located in the northwest corner of the subject property. It is generally low and poorly drained. Because it is low, there are many remnant backwater channels that would be flooded when the water is higher (e.g., spring runoff). The area is about 150m back from the river. As the first 50m does not exhibit qualities associated with archaeological potential, it is acceptable to discount the

100m beyond that as well. It is suggested that this area be reclassified as not having archaeological potential.

Archaeological Potential Area C - This thin triangle exhibited none of the qualities associated with archaeological potential. It is several hundred metres from any significant water source, in undulating bedrock terrain and there is no feature associated with it that would suggest archaeological potential. It is suggested that this area be reclassified as not having archaeological potential.

Archaeological Potential Area D - This area is located primarily along the north bank of the Canon Creek. The western extents of this area are poorly mapped as the mapped potential is a thin strip that straddles the river as the river meanders. There are gravel banks here but the gravel has been stripped away by erosion and shoreline stabilization engineering has been effected. If there was any archaeological potential here, it was washed away long ago. Along the eastern edge of the property north of the Canon Creek, there is a larger area of potential, seemingly falling within the 150m buffer from the Canon Creek. The first 50m of the river here is undulating, with exposed bedrock knobs, rocks and cobbles in the soils and poorly drained. This area does not exhibit the qualities of having archaeological potential and should be reclassified as not having archaeological potential.

Archaeological Potential Area E1 - This area has all but been removed by earth moving operations. This area should be reclassified as not having archaeological potential.

Archaeological Potential Area E2 - This area is a gravel hill. The hill appears to have been logged and cleared approximately 30-40 years ago. There is significant evidence of earth moving. Push piles of earth are found throughout as are remnant logging tracks. On the south side of the hill, considerable portions of the hillside have been removed through earthmoving. It would appear that this area was identified as having high potential due to being within 150m of water. The portion of this area that is within 50m of the Canon Creek is too steep to scale, thus the balance of the 150m should be reclassified as not having archaeological potential.

Archaeological Potential F, G, H - These areas are within the active landfill areas and have been extensively remodelled. These areas should be reclassified as not having archaeological potential.

Archaeological Potential Area I - This is an area identified as having archaeological potential along the banks of the Canon Creek. This area includes previous landfilling activities and Canon Creek was realigned in this area in 2006 to increase separation from the landfill. In September 2013, an extreme weather event resulted in record high water eroding the river banks down to rock - all the soils were removed. Due to the soils being removed by erosion, and previous river course engineering, this area should be reclassified as not having archaeological potential.

Archaeological Potential Area J - This area of archaeological potential is a seasonally flooded embayment of the river. River flood channels and undrained pools, wetlands

and trapped water predominate in this area. This area should be reclassified as not having archaeological potential due to wet soils, seasonal flooding and generally not being a place one would set up camp.

Archaeological Potential Area K - This area is stretch of land extending 100m back from Fifth Line East. The potential here was likely ascribed due to a 100m buffer around roads as pioneer potential. Fifth Line was never a pioneer road and even today, it does not extend more than 1.5 kilometres west of Great Northern Road. This area of archaeological potential was examined and there is no evidence for house foundations. It is recommended that this area of archaeological potential be reclassified as not having archaeological potential.

Archaeological Potential Area L - This area is a relatively flat area, approximately 3-5 metres higher in elevation than Area J. The trees are generally uniform in age (having been cut in the last 30 years). Several larger spruce stand near the edge of area. Evidence of buried dumping is found throughout the area as is road/tracks for access. Test pits were excavated in this area. All test pits exhibited evidence that original soils did not exist. It would appear that this area was also stripped after logging. All the soils were unconsolidated and mixed with plastic and other modern materials being found 10-15cm below the surface. After evaluating the information obtained through test pitting, it became clear that this area should be reclassified as not having archaeological potential.

Potential Effects and Mitigation:
As summarized in **Table 7.5**, no archaeological sites were found. It is recommended that no further archaeological assessment of the property is required.

Table 7.5
ARCHAEOLOGY – SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Presence of known or potential archaeological resources on site.	No archaeological sites were found.	• Should undocumented archaeological resources be uncovered during landfill construction, alteration of the site must cease immediately. • If undocumented archaeological resources are uncovered, a licensed archaeologist should be contacted to carry out archaeological fieldwork in compliance with Section 48(1) of the Ontario Heritage Act.	No net effects anticipated.

7.3.2 Social

Data Collection:
Primary and secondary sources were used in order to inventory the existing conditions as follows:

Secondary Source Information Gathering: To gather information relevant to the study area, secondary source information was collected and reviewed. This was done using aerial mapping, street views of the roads within the study area (using Google Earth) and recording all social features either adjacent to the road or at access and egress points. Local and municipal websites and Census data from Statistics Canada were also used.

Primary source information gathering included:

- Windshield survey of study area - In order to confirm and update secondary source data, a windshield survey of the study area was undertaken in July 2013. To do this, staff drove through the study area and documented all social features (e.g. schools, recreation facilities and open spaces, churches etc), and residences within the 1 km and 2 km study areas so that an overall picture of the area and its features could be ascertained.
- Residents' Surveys - A self-completion survey was hand delivered to all residences within 1 km of the landfill site. Residents were able to return the survey by mail or complete it online. This survey covered aspects such as current use and enjoyment of private property (including issues related to the existing landfill), satisfaction with living in the community and concerns related to the construction and future operation of the landfill.

To assess the potential for social impact as a result of the proposed expansion, information was also obtained on the potential for noise, dust, odour and other impacts from other project team disciplines.

The study area used for the social impact assessment included residents within 1 km of the site footprint and all other features and businesses within 2 km of the site.

Existing Conditions:
There are approximately 177 residences within 1 km of the site; 152 homeowners and 25 tenants. However, significant portions of the study area remain largely unspoiled by development. Residential properties in the vicinity of the site are generally situated on large plots and the study area is not densely populated with homes. The area features a large amount of green, open space and aggregate resource extraction.

A number of churches and cemeteries, one school and a conservation area (Hiawatha Highlands) were observed within the 2 km study area.

The residents' survey asked a number of questions related to peoples use and enjoyment of their property, community issues and likes and dislikes about the community. In total, 39 surveys were completed (either partially or fully).

The following summarizes survey respondents' sentiments regarding their community:

- The area is an established neighbourhood with over half the respondents being in their place of residence for more than 11 years.
- Resident's typical use of their backyard space is for relaxing, barbequing and gardening.
- Noise or quietness has the most influence on resident's enjoyment of their outdoor space.
- Peace and quiet is the primary aspect respondents appreciate about their community.
- Speed and volume of traffic on Fifth Line East and Old Goulais Bay Road were identified as the most disliked aspect of the community. Other dislikes included odour from the landfill, garbage on the road, and truck/traffic noise.
- Respondents identified the key ways the neighbourhood was changing to include the construction of more homes, additional traffic, and more noise and increasing odour from the landfill.
- Most respondents identified being satisfied or very satisfied with being in their community.

The residents' survey identified some issues with the landfill – primarily trucks, odour and garbage on the road. Official odour complaints lodged with the City of Sault Ste. Marie were made available and show that over the period from 2009 to 2014, 62 complaints (average of 10/year) regarding odour had been made to the City. The highest number of complaints was registered in 2010 when 17 complaints were lodged relating to a sewage-like odour.

The increased number of odour complaints in 2010 coincided with the landfill gas management construction project. Prior to initiating construction, notices were mailed to property owners in the vicinity of the site to inform them of the proposed landfill gas construction project and the potential for off-site odours despite the planned mitigation efforts. The mitigation strategies employed included application of daily cover following trenching operations and application of odour control products to exposed wastes. The active landfill gas collection system became operational on a part time basis in early December, 2010 and became fully operational the last week of January, 2011.

Potential Effects and Mitigation:

The residential survey asked a number of questions relating to whether respondent's use and enjoyment of their property was affected by the current landfill and the potential for a change in satisfaction or usage of outdoor spaces as a result of construction and operation of the proposed expansion.

When asked to respond in their own words to questions about the landfill and improvements, the focus of responses was on odour, noise, traffic, water quality, litter and community information.

This information, combined with information on the potential nuisance effects (i.e. odour, noise, traffic) associated with the proposed expansion was used to assess the potential for social impacts. A summary of the social impact assessment is included in ***Table 7.6.***

Applicable monitoring programs and mitigation measures will be implemented to ensure that there are no significant increased nuisance effects (above the existing conditions) for local people. It is anticipated that some of the proposed enhancements (e.g. Biosolids processing facility) will reduce nuisance impacts for area residents.

Table 7.6
SOCIAL – SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Mitigation Measures	Net Effects
Presence of existing residences on site, off site in the vicinity of the current or potential site and along the access route(s).	No land acquisition is required for the expansion and thus no residents will be displaced.	No mitigation required.	No net effects anticipated.
	Construction of an expansion could result in residents feeling inclined to leave the community. However, residential surveys suggest very few residents will move from the area as a result of the landfill.	No mitigation required.	No net effects anticipated.
	Nuisance effects from both construction and operations at the landfill may disrupt the extent people can use and enjoy their/ public property (both inside and outside). Overall, no significant increase in noise, traffic nuisance effects or water quality impacts are anticipated from the proposed landfill expansion assuming appropriate mitigation.	• On-going engagement with the public. • Construction of the proposed on-site berm to shield noise generating activities at the composting pad. • Implementation of hydrogeology mitigation including a residential well monitoring program.	Minimal net effects anticipated.
	Some additional odour is likely during landfill mining.	Odour will continue to be managed through the landfill gas management system. Section 7.3.7 provides a complete outline of odour mitigation and includes: • Continuation of current operational practices to reduce odour; • Best management practices for odour managed during landfill mining including development and implementation of an Odour Management Plan; • Construction of a Biosolids	Minimal net effects anticipated.

Table 7.6
SOCIAL – SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Mitigation Measures	Net Effects
		Management and Processing facility; • Staged expansion of the landfill gas collection system; • Keeping local residents informed of landfill mining timing and duration; and • Responding to public complaints.	
Presence of institutional, community and recreational features on the site, off site, in the vicinity of the current or potential site and along the access route(s)	Nuisance effects from both construction and operations at the landfill may disrupt the extent people can use and enjoy the school, churches and conservation area identified within the study area. As noted above, no significant increase in nuisance effects (i.e. noise, odour or traffic) or water quality impacts are anticipated from the proposed landfill expansion assuming appropriate mitigation.	Mitigation as noted above.	Minimal net effects anticipated.
Presence of First Nations reserves and communities and spiritual, cultural or ceremonial and traditional use sites.	The City has not been made aware of any First Nations Reserves, communities or spiritual, cultural or ceremonial and traditional use sites within the landfill site. Stage 2 Archaeological assessment completed and no archaeological resources identified.	Continue to reach out to Aboriginal Communities as the project continues to move forward and incorporate mitigation as necessary.	No net effects anticipated.
Community characteristics	The presence of the landfill may have an effect on the character/cohesion of the community and its cohesion due to changes in behaviour and attitude. It is noted that the existing Community has adapted to the landfill operations and there was little evidence from the residents' survey to suggest that people's satisfaction with the community would change as a consequence of the landfill expansion.	Ongoing engagement with the public to continue. The City remains committed to a process of continual improvement.	No net effects anticipated.

7.3.3 Planned Land Use

Data Collection:
The approach taken to complete the land use impact assessment was to inventory the land uses within the study area, identify potential impacts the proposed expansion may have relative to relevant MOECC guidelines and City of Sault Ste. Marie land use policies and guidelines and develop mitigating measures to address potential impacts.

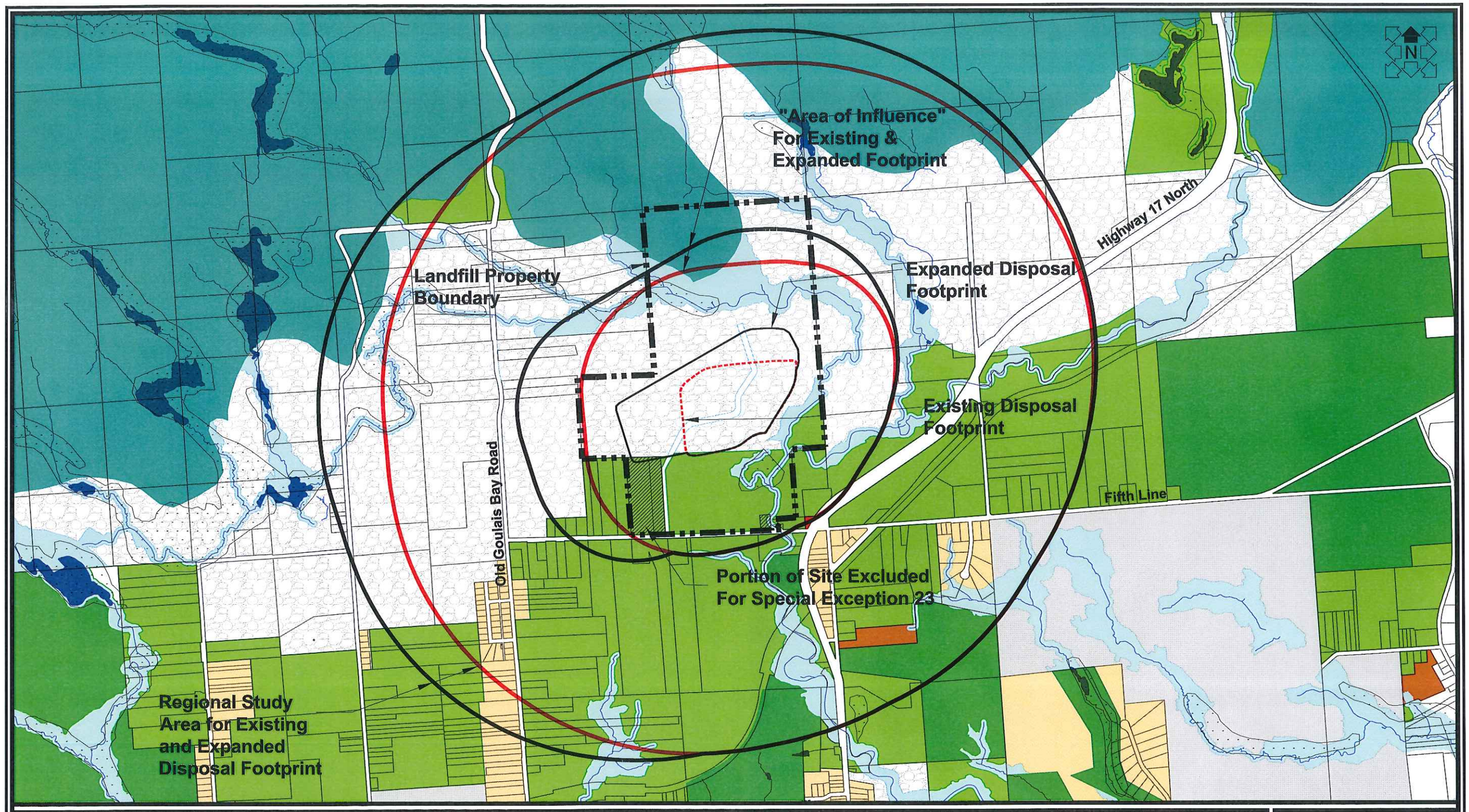
For the purposes of the detailed impact assessment, the "on-site study area" is defined as lands within the preferred landfill footprint (existing and expansion areas). The "site vicinity study area" is defined as all properties lying wholly or partially within a 500m radius of the "on-site study area" and the "regional study area" extends an additional 1km from the "site vicinity study area".

Existing Conditions:
On-Site - The existing land uses within the on-site study area consist of existing waste disposal activities (existing disposal footprint), organic processing (i.e. leaf and yard waste composting in open windrows, curing and screening compost and storage of the final product) and wooded area. All of the lands required for the waste disposal activities and ancillary activities are currently owned by the City of Sault Ste. Marie.

The on-site study area is designated Rural Area in City's Official Plan, and zoned Rural Area (RA) and Rural Aggregate Extraction (REX) in the City's Zoning By-law. A significant proportion of this area is also subject to Special Exception 23. Special Exception 23 allows use as a sanitary landfill where "sanitary landfill site" shall mean a place where waste is deposited under controlled conditions including proper compaction and regular covering with an approved cover material. It also may include ancillary operations associated with the landfill site such as, but not limited to, leachate collection, site access, storage and maintenance of heavy equipment, weigh scales and monitoring wells.

The current zoning by-law was approved in 2005 and since that time, the City has acquired additional properties adjoining the landfill site which has resulted in an expansion of the landfill property boundaries. As a result of the latest land acquisitions and the proposed landfill expansion, a municipal zoning by-law amendment is required to adjust the "Sanitary Landfill Site" boundary defined by Special Exception 23 Schedule to coincide with the expanded property boundaries. Refer to **Figure 7.3** for the current property and Special Exception 23 boundaries.

The landfill site is situated within the City's Groundwater Recharge Protection Area and the Source Water Protection Plan (SWPP) identifies this area as a future moderate and low threat. The SWPP encourages the City to include specific policies, in its Official Plan, to manage specific activities to protect this resource. The City's Official Plan specifically addresses this matter under Section 4.1 entitled "Groundwater Recharge Protection Area" which prescribes specific policies for the management and storage of



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THE CORPORATION OF THE CITY OF SAULT STE. MARIE

- Rural Precambrian Uplands
- Rural Area Zone; RAhp
- Rural Aggregate Extraction Zone
- Institutional Zone
- Parks and Recreation Zone
- Mobile Home Residential Zone
- Highway Zone
- Estate Residential
- Environmental Management

LAND USE IMPACT ASSESSMENT STUDY AREA AND EXISTING ZONING

Project 60117627
Jan 2015

Figure 7.3

fuel and chemicals, vehicle maintenance, repair and storage, spill response, and storm water management.

Site Vicinity - The site vicinity study area includes all properties lying wholly or partially within a 500 m radius of the proposed expansion footprint. This area coincides with the area of influence of a landfill site a prescribed in MOECC Guideline D4: Land Use On or Near Landfills and Dumps. The existing land uses within the site vicinity study area include ancillary waste management and disposal activities (i.e. weigh scales, leachate collection and management, site access, maintenance and storage of heavy equipment, administration offices, public drop-off for waste and recyclables, landfill gas blower station and flare), residential (single family homes), recreational (campground), aggregate extraction operations, and contractor's yards.

Within the Official Plan and Zoning By-Law all of these properties are designated Rural Area and zoned Rural Area, Rural Precambrian Uplands, Environmental Management, Rural Aggregate Extraction and Highway. In addition the following Special Exceptions apply within this area; S-11, S-23, S-113, S-228, S-233, S-239, S-303.

The proposed expansion of the site will result in a moderate increase in the site's area of influence as defined in MOECC Guideline D4 and illustrated in **Figure 7.3**. There are a total of 12 properties located within the site's expanded area of influence that are not included in the existing site's area of influence. These properties are summarized in **Table 7.7**.

Table 7.7
LAND USES IN EXPANDED AREA OF INFLUENCE

Current Land Use	Quantity	Zoning
Residential	8	Rural Area and Aggregate Extraction
Contractor Yard/Aggregate Extraction	2	Rural Area and Aggregate Extraction
Vacant/inactive (includes a former race track)	2	Rural Area and Aggregate Extraction

Regional Study Area - The regional study area consists of all properties outside of the site vicinity study area and lying wholly or partially within a 1 km radius from the site vicinity study area. There is a broad mix of land uses within the regional study area. Within the Official Plan all of these properties are designated Rural Area. Zoning includes Rural Area, Environmental Management, Rural Aggregate Extraction, Rural Precambrian Uplands, Highway, Estate Residential, Mobile Home Residential and Parks and Recreation.

Potential Effects and Mitigation: Land use planning in the vicinity of landfill sites is guided by City planning policies and guidelines and MOECC Guidelines D1: Land Use Compatibility and D4: Land Use On or Near Landfills and Dumps.

City Planning Policies - The following summarizes how City Official Plan policies are addressed. Further details on potential effects and proposed mitigation for each of these can be found in other sections of this document.

- Heritage –City Official Plan policy requires an Archaeological Impact Assessment prior to construction. This work was completed and no archaeological sites were found within the limits of the investigation.
- Natural Heritage – City Official Plan policy requires an Environmental Impact Study to assess possible impacts of new development. The Natural Heritage Impact Assessment completed for the proposed expansion meets these requirements and identified no net effect on the terrestrial or aquatic environment.
- Groundwater Recharge Protection Area – City Official Plan policy addresses the specific policies to manage potential impacts in recharge areas. Section 4.1 entitled "Groundwater Recharge Protection Area", prescribes specific policies for the management and storage of fuel and chemicals, vehicle maintenance, repair and storage, spill response, and storm water management. Given that the landfill site operations include many of these prescribed activities, these policies are relevant to the existing site and the proposed site expansion and have been and will continue to be addressed through site design and operations. In addition the Official Plan policies also identify a need for a spill response action plan which is to be reviewed and updated annually. This requirement is addressed for the existing site and will be updated for the expanded site.

MOECC Guidelines

- Guideline D1 is intended to minimize or prevent, through the use of buffers, the exposure of any person, property, plant, or animal life to adverse effects associated with the operation of specified facilities. It is intended to apply when a change in land use is proposed and a sensitive land use is within an area of influence. This Guideline is relevant as a zoning change is required to facilitate the proposed expansion and sensitive land uses exist within the expanded area of influence. In accordance with Guideline D-1, adequate separation based on the facility's influence area is the preferred method of mitigating adverse effects. In cases where the required separation is not available, potential compatibility problems need to be addressed through the completion of studies to assess the level of impact and develop appropriate mitigation. These studies have been completed and mitigation proposed as part of this EA.

Guideline D-4 prescribes the specific area of influence that applies for a landfill site and is used to confirm whether a potential compatibility concern exists with proposed changes in land use. D-4 specifies restrictions and controls on land use that the MOECC wishes to see implemented in the vicinity of landfills in order to protect the health, safety, convenience and welfare of residents near the facility. MOECC considers the most significant contaminant discharges and visual problems to typically occur within 500m of the perimeter of the fill area. For the purposes of this proposal the site vicinity study area reflects this area of influence as prescribed by the MOECC.

Of the 12 additional properties within the site vicinity study area, 8 of them are residential and considered sensitive. In order to address potential impacts the following detailed impact assessment studies have been completed as part of the EA:

- Air Quality and Odour Impact;
- Noise Impact;
- Hydrogeological (groundwater) Impact;
- Traffic Impact;
- Socio-Economic Impact;
- Visual Impact; and
- Surface Water Impact.

The impacts identified through these studies and the proposed mitigation are summarized in other sections of this EA.

Table 7.8 summarizes the results of the planned land use impact assessment.

It is noted that the City will proceed with rezoning as required and will consider the purchase of additional buffer properties at market prices in the vicinity of the landfill as it becomes available.

Table 7.8
PLANNED LAND USE SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Official Plan designations and zoning on site, off site and in the site vicinity.	Additional property will need to be re-zoned under Special Exemption 23.	Implementation of mitigation measures as identified in other discipline reports to address potential: • Air quality and odour impact; • Noise impact; • Hydrogeological impact; • Traffic impact; • Socio-economic impact; • Visual impact; and • Surface water impact.	Minimal potential for odour effects associated with landfill mining. No other net effects anticipated.
Future development proposed in the site vicinity and along the access route(s)	If new sensitive land uses are permitted to develop within the sites expanded area of influence there is the potential for increased overall net effects.	The City will consider the expanded area of influence in deliberating over any proposed land use matters that fall within their control.	No net effects anticipated.

7.3.4 Visual

Data Collection:
The assessment of visual impacts associated with the Preferred Alternative Landfill Expansion was undertaken through the collection and assessment of the following:

- Desk top review of the site and surrounding area using the Google Maps® and Google Streetview® software program.
- Review of the existing topography of the site and the neighbouring lands within the study area.
- Review of photographs taken from key locations on site and neighbouring lands to understand land use and the significance of views and vistas.

The study areas for the visual impact assessment included on-site - the lands required for the Preferred Expanded Landfill footprint; site-vicinity - the lands in the vicinity of the Preferred Alternative Landfill Expansion, extending about 500 metres in all directions from the edge of the preferred landfill expansion; and, a regional study area - the lands within approximately 1.5 kilometres of the Preferred Alternative Landfill Expansion.

Existing Conditions:
The present landfill feature is located on the east side of the site and is surrounded by existing vegetation and hilly topography. In general, the existing surrounding vegetation and topographic features block any views to the site and present landfill form from all immediately adjacent viewpoints. At present, there is only one opportunity to view the interior of the site from the adjacent surrounding areas. This view is isolated and limited occurring at the entrance to the landfill facility along Fifth Line East.

The effectiveness of the screening is dependent on a few factors including: the surrounding topography; the presence, density and make-up of vegetation surrounding the site; and the distance of the viewer from the site. The surrounding region generally falls away to the south from a ridge of hills that is located immediately north of the landfill site. The topography creates an effective visual block of the site from surrounding areas to the northwest, north, and northeast.

Distant views of the site are well screened due in large part to the expansive existing vegetation growth that covers much of the area. The coniferous – deciduous tree ratio of the existing vegetative cover varies at different locations around the site. The cover is predominantly deciduous to the north, west, and east but changes to predominantly coniferous in areas south of the site. The width of these vegetative buffers is significant in all directions. As the viewer moves away from the site, more elements located in the middle-ground and in the foreground provide increased visual screening. On a regional level, there is a very effective visual screen that surrounds the existing landfill feature.

Potential Effects and Mitigation:
As a result of this assessment it has been determined that the expansion of this landfill feature will have no significant adverse impact on the visual make-up of the existing landscape. The existing topography and vegetation that covers the area is quite effective in screening the interior of the landfill site from external viewpoints. The height

of the landfill expansion will attain an elevation that is higher than the surrounding lands to the south, east and west, however the landform will not be visible from a distance due to the fact that the land continues to drop in elevation as one moves away from the site, and that the existing vegetation cover is dense and expansive across the area.

Within the site-vicinity and regional study areas, views of the landfill expansion will vary from fully obscured to moderately visible.

- Distant views in general from all directions around the site will not be adversely impacted by the introduction of the preferred landfill expansion due to the presence of existing vegetation and topographic features. There is the potential of observing a minimal amount of the top of the preferred expansion from the south. However given the distance of the observer from the landfill site, and the presence of existing topographic features located immediately north of the site, it is highly doubtful that the feature will be distinguishable or stand out from the surrounding landscape.
- Close-Up Views (Site-Vicinity) from the northwest to the northeast will be unaffected by the introduction of the preferred landfill expansion due to the presence of existing significant growths of vegetation and topography immediately adjacent to the site. These features effectively isolate the landfill site from areas to the north. The land falls away to the south, making the existing vegetative cover more effective at screening close-up views of the landfill from the west, south, and east.
- The footprint and elements of the site infrastructure redevelopment extend to a point on the west that comes close to the existing hydro easement that runs north-south through the area. This creates an isolated glimpse of the expanded landfill feature from Fifth Line East and on existing residential property that borders the southwest edge of the site. The landfill feature will not be totally visible as there will still be a remnant vegetative screen along the property line. If left untreated, it is possible that the upper 10 to 15 metres of the landfill could be visible when completed.

Table 7.9 summarizes the visual impact assessment.

Table 7.9
VISUAL SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Views/viewsheds of the facility in the site vicinity.	The assessment indicates that the proposed expansion at completion will not interfere, obscure or compete with any nearby man-made or natural landmarks, nor will it significantly alter the existing vistas within the study area. The visual impact of the preferred landfill expansion is dependent on how it is perceived by the public from surrounding viewpoints.	Mitigation proposed to lessen the impact of the preferred expansion includes: • planting of vegetative buffers on berms where necessary to obscure the feature from the surrounding areas. • measures such as a native grass/wildflower vegetative cap mixture that will improve the aesthetic quality of the landfill feature itself.	Minimal net effects anticipated.

7.3.5 Atmospheric Noise

Data Collection:
The noise impact assessment completed for the proposed expansion involved the following steps:

- Identification of all dominant noise sources at the site;
- Determination of worst-case noise emission scenario;
- Acoustical modelling of the site under the defined worst case scenario to predict worst-case noise impacts at nearby receptors;
- Comparison of the predicted maximum receptor sound levels with the applicable criterion for landfills to determine compliance; and
- Determining noise mitigation measures in cases of non-compliance.

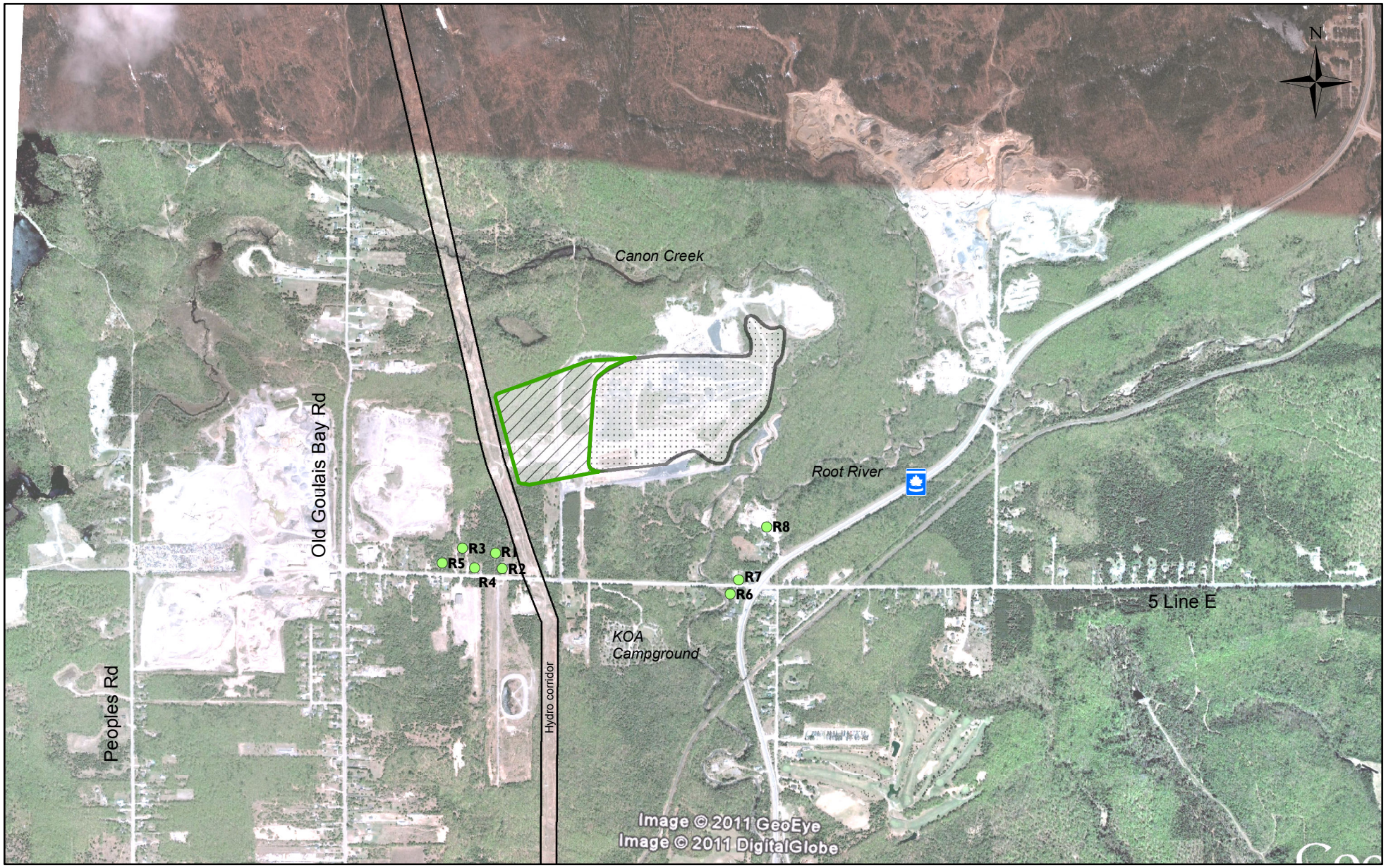
Data collection included determining the noise source characteristics for all equipment in use at the landfill for operation and construction. Eight future operational scenarios representing different stages of landfill operations and construction were considered. A screening level assessment was undertaken based on the vehicles, equipment and activities at the site to determine the worst case noise impact.

For the purpose of this assessment, the potential noise impact was assessed at the nearest receptors which included eight (8) locations in the vicinity of the landfill site as shown on **Figure 7.4**.

Existing Conditions:
Noise emissions from the site are dominated by activities such as vehicular traffic along on-site roads and the operation of heavy equipment such as bulldozers, compactors and earth moving equipment. Specifically, the following site operations details were incorporated into the noise assessment modelling for the proposed expansion:

- Landfill staging – Landfilling operations will regularly change in location thus the worst-case is assumed to be operations closest to receptor locations.

- Site access – Trucks will all enter off of Fifth Line. Those with municipal solid waste will go to the tipping face and public vehicles will go to the drop-off.
- Working face – Noise generating equipment assumed to be operating at the working face includes a compactor, odour control unit, and a dozer/front-end loader. To be conservative it has been assumed that the typical operating berms at the working face would not be installed.
- Cell construction – Noise generating equipment assumed to be operating for cell construction includes a dozer and haul trucks for gravel hauling and placement.
- Landfill gas flare system – Noise sources for this activity include the blower and flare.
- Stockpile – Noise generating equipment assumed at the stockpile is an articulated dump truck to transport material from the stockpile to the working face.
- Composting pad – The composting pad will be relocated to an area immediately south of the south-east quadrant of the expanded fill area. Noise generating equipment at this location will include a front-end loader, a water truck, a tractor and a trommel screen.
- Site maintenance – Various construction and maintenance activities at the site are assumed to include a backhoe, a water truck a Kobota 4x4, a plow truck and a sweeper. It is noted that the maintenance vehicles will not necessarily be operational at the same time. For the purpose of assessment, those with higher noise levels that can operate simultaneously have been considered.



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Meters

Legend

- Noise Receptor
- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- TRANS-CANADA HIGHWAY

Sault Ste. Marie Municipal Landfill Site

EXISTING SAULT STE. MARIE LANDFILL SITE AND NEARBY RECEPTORS

Project Manager:	KK	Drawn By:	SLP
Scale:	1 : 20000	Checked By:	XXX
Date Issued:	FEB 2015	Project No:	06-6988
Location:	I:\066988\	File Name:	Nearby Receptors

Figure No.

7.4

The Ministry's publication "Noise Guidelines for Landfills" (MOECC, 1992) applies to the operations at the Sault Ste. Marie Landfill in terms of absolute sound exposure from landfill operations. The guidelines specify a daytime (7:00am and 7:00pm) receptor noise criterion of 50 dBA and a nighttime (7:00pm and 7:00am) receptor noise criterion of 45 dBA. These sound exposure limits apply to any receptor, in any worst-case hour of operation at the landfill. The acoustical descriptor used is the one-hour energy equivalent continuous sound exposure, denoted as "Leq (1)".

The landfill operates only during the day; therefore, this assessment pertains to daytime hours (7:00am – 7:00pm) only. For the purposes of this assessment, the predicted worst-case hourly sound level equivalent (Leq(1)) at the receptors, resulting from the operations at the landfill, are compared against the MOECC's Class 2 Area daytime criterion of 50 dBA.

The details of each noise source, including octave band sound levels as well as acoustic modelling details and results are in accordance with MOECC publications NPC-233 – Information to Be Submitted for Approval for Stationary Sources of Sound. The noise impact considerations for the landfill site, including sound level limits and the potential noise sources considered in the assessment are in accordance with the Ministry publication "Noise Guidelines for Landfill Sites."

Potential Effects and Mitigation:

The modelling results without noise mitigation indicate that with the exception of one receptor (i.e., R1) the predicted receptor sound levels are below the MOECC's daytime criterion of 50 dBA for landfills.

To achieve compliance at the one receptor, mitigation is required. The mitigation proposed is the installation of a 2.5 m high perimeter berm that provides shielding of noise generating activities at the composting pad for the receptors to the southwest of the pad. The berm would be 150m in length and will be located along the south and west sides of the pad.

The modelling results for the worst-case scenario with no mitigation and with the above-mentioned noise mitigation measures are shown in **Table 7.10**. No additional noise mitigation measures are required. **Table 7.11** summarizes the noise impact assessment.

Table 7.10
PREDICTED RECEPTOR SOUND LEVELS – WORST-CASE SCENARIO (SCENARIO 8)

Receptors		Receptor Height (m)	Elevation (m)	Applicable Criterion (dBA)	Predicted Sound Pressure Level without Mitigation (dBA)	Predicted Sound Pressure Level with Mitigation (dBA)	Compliant (Yes/No)
ID	Description						
R1	Assumed 2-storey residential dwelling	4.5	282.1	50	50.2	48.0	Yes
R2	Assumed 2-storey residential dwelling	4.5	281.5	50	49.1	46.9	Yes
R3	Assumed 2-storey residential dwelling	4.5	282.0	50	48.5	47.9	Yes
R4	Assumed 2-storey residential dwelling	4.5	281.5	50	47.9	45.9	Yes
R5	Assumed 2-storey residential dwelling	4.5	281.7	50	46.4	45.8	Yes
R6	Assumed 2-storey residential dwelling	4.5	278.5	50	39.5	39.5	Yes
R7	Assumed 2-storey residential dwelling	4.5	280.7	50	39.9	39.9	Yes
R8	Assumed 2-storey residential dwelling	4.5	281.0	50	39.5	39.5	Yes

Table 7.11
NOISE SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Ambient (baseline) noise conditions.	Construction and operation of the proposed expansion has the potential to result in noise at nearby receptors. Based on the noise assessment undertaken for the proposed expansion, one receptor exceeds MOECC noise criteria.	The installation of a 2.5 metre high perimeter berm along the south and west sides of the compost pad effectively provides shielding of noise generating activities at this location. With this mitigation the noise levels from the proposed landfill expansion are within the MOECC noise criteria for all receptors.	No anticipated net effects.

7.3.6 Atmospheric Air Quality & Dust

Data Collection:

The air quality assessment for the proposed Sault Ste. Marie Landfill Expansion was completed using the following steps:

- Definition of baseline concentrations of indicator compounds based on ambient air quality data;
- Review of future operational scenarios (including equipment location and estimated emissions) to select a worst-case operating scenario specific to air quality;
- Prediction of off-property concentrations of air quality indicator compounds; and
- Comparison of the predicted concentrations and baseline conditions to relevant air quality criteria.

The indicator compounds selected for the air quality assessment were those of greatest significance from typical landfill operations, namely:

- Oxides of Nitrogen (NOX) - Generated from combustion of fuel in mobile and stationary equipment at the landfill.
- Total Suspended Particulate (TSP) - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/surfaces and material handling and movement.
- Particulate Matter with aerodynamic diameter less than 10µm (PM10) - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/surfaces and material handling and movement.
- Particulate Matter with aerodynamic diameter less than 2.5µm (PM2.5) - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/surfaces and material handling and movement.

Existing Conditions:

In order to define existing air quality (baseline conditions), a review was done of ambient air quality monitoring stations in close proximity to the landfill. The Ministry of the Environment's Sault College station was selected as the preferred source of baseline conditions because of the availability of PM2.5 and NOX data from this site. The Sault College station is located more than 6km to the south of the project site, and more than 4km east of the major industrial activity within the City of Sault Ste. Marie. In the area of the project site, winds are predominantly from the North West, East and South East. **Table 7.12** shows the baseline air quality for the indicator compounds chosen. The table also shows the Ministry of the Environment Ambient Air Quality Criteria which defines the "desirable concentration" of a contaminant in air, based on protection against adverse effects on health or the environment. As shown in the table, all indicator compounds are within the allowable criteria.

Table 7.12
BASELINE AIR QUALITY FOR INDICATOR COMPOUNDS

Pollutant	Averaging Period	Baseline Concentrations (90th Percentile) (µg/m³)	Relevant Ambient Air Quality Criteria (µg/m³)
NO_2	1-hour	26.3	400 – Ontario AAQC[1]
NO_2	24-hour	22.6	200 – Ontario AAQC
TSP[2]	24-hour	36.5	120 – Ontario AAQC
PM_{10}[3]	24-hour	15.2	50 – Interim Ontario AAQC
$PM_{2.5}$	24-hour	9.1	30 – Canada Wide Standard

Notes: 1. AAQC is defined as a "desirable concentration" of a contaminant in air based on protection against adverse effects on health or the environment.
2. Regional ambient monitoring data for TSP was not available for the period 2011 to 2013. TSP was estimated assuming that PM2.5 accounts for ~25% of TSP, which is higher than the values found from a literature survey of available data (Canadian and Ontario). The values found ranged from 18% to 24%.
3. Regional ambient monitoring data for PM10 was not available. PM10 was estimated assuming that PM2.5 accounts for ~60% of PM10, which is based on research conducted by the MOECC in Ontario ("A Compendium of Current Knowledge on Fine Particulate Matter in Ontario", dated March 1999).

Potential Effects and Mitigation:

The evaluation of potential effects of the project activities on air quality included the following tasks:

- Analysis of Operating Scenarios – The worst-case operating scenario for air quality was used to determine the potential air quality effects of the expansion. To determine the worst-case, eight (8) future operational scenarios representing different stages of landfill operations were considered.
- Emission Estimation - Emissions of indicator compounds from significant sources/activities at the landfill, including vehicles travelling into and out of the site, vehicles and equipment traveling within the site, combustion emissions from stationary and mobile equipment operating within the site, and the handling of materials within the site were estimated for the worst-case scenario.
- Dispersion Modelling and Analysis of Potential Effects - Air dispersion modelling was used to predict the maximum off property concentrations of indicator compounds. These maximum concentrations were combined with the corresponding baseline air quality concentrations to define a predicted cumulative impact, and compared to the pertinent ambient air quality criteria. The criteria used in this assessment include:

    - Ontario Ministry of the Environment "Ontario's Ambient Air Quality Criteria," dated April 2012, and
    - Canadian Council of Ministers of the Environment "Canada-Wide Standards for Particulate Matter (PM) and Ozone", dated June 2000.

Table 7.13 presents the maximum predicted pollutant concentrations, for off-property receptors. With background concentrations considered, no exceedances of relevant criteria were predicted.

Table 7.13
SUMMARY OF PREDICTED CONCENTRATIONS OF AIR QUALITY INDICATOR COMPOUNDS

Indicator Compound	Averaging Period	Baseline Air Quality Concentration (µg/m³)	Predicted Maximum Off-Property Concentration (µg/m³)	Predicted Maximum Cumulative Air Quality Concentration (µg/m³)	Relevant Air Quality Criterion (µg/m³)
NO_X	1-hour	26.3	399.6	425.9	—
NO_X	24-hour	22.6	42.4	65.0	—
NO_2	1-hour	—	—	103.3	400
NO_2	24-hour	—	—	36.9	200
TSP	24-hour	36.5	67.3	103.8	120
PM_{10}	24-hour	15.2	20.7	35.9	50
$PM_{2.5}$	24-hour	9.1	5.0	14.1	30

Table 7.14 summarizes the assessment of impacts for air quality and dust.

Table 7.14
AIR QUALITY & DUST SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Ambient (baseline) air quality conditions.	Based on the air quality assessment of the proposed expansion no exceedances of relevant criteria were predicted.	No mitigation required	No net effects anticipated.
Ambient (baseline) dust conditions.	Off-site dust effects are influenced by site activities and conditions. The air quality assessment identified that air quality parameter (NO_x, TSP, $PM_{10,}$ and $PM_{2.5}$) levels are anticipated to be within MOECC criteria. It is acknowledged however that at times dust from construction and operation of the proposed expansion can be a source of nuisance.	Best management practices for dust at the site will include watering of gravel roads when needed. In addition the main access road and site perimeter road shall be hard surfaced to minimize dust nuisance.	Minimal net effects anticipated.

7.3.7 Atmospheric - Odour

Data Collection:

The odour assessment of the proposed landfill expansion is based on a qualitative assessment of the odour potential of operations at the Site, in the context of the Ministry of the Environment's recommended FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) approach.

The baseline and future operations of the project were compared to determine whether significant changes in the odour profile of the site would be expected. Where significant changes may occur, an analysis was done on the approaches to be used at the Site to reduce the potential for odour impacts.

Existing Conditions:
The baseline environment at the Site is characterized by an odour profile typical of the disposal of waste in a landfill. The Site maintains relationships with neighbours and staff are trained on the management of odour from the operations.

Practices in place to manage odourous emissions from the Site are documented within the Annual Design and Operations Report for the Site. A historical summary of the actions taken by the City to better manage nuisance odours includes:

- A formalized complaint recording procedure was adopted and complaints are analysed to assist in the determination of the source of odours and factors contributing to odour complaint incidents (e.g., weather). Where practical, additional actions are taken to mitigate odours at the time of the complaint.
- In 2003, an odour study was completed to identify the potential origin of odours generated at the Site. Based on the findings of the study, the City initiated several activities to reduce odour from suspected sources, including:
    - Changes to sludge handling;
    - Purchase and deployment of odour control granules to neutralize surface emissions; and
    - Application of clay cover to an inactive but uncompleted area (due to settlement) of the landfill in the northeast corner.
- In 2004, twenty-four (24) flares were installed in the northeast portion of the landfill. The flares were inspected on a regular basis and necessary maintenance was undertaken to ensure continuous combustion. Six (6) additional vent flares were installed in 2007, bringing the total up to thirty (30). The vent flares were effective in mitigating odour impacts from landfill gas emissions.
- In 2006, an odour control spray system was also installed along a portion of the south fence line. The system included four (4) spray nozzles mounted directly on the fence. The system ran 24/7 approximately nine months of the year (i.e., April to November). This system was decommissioned in 2010 when excavation activities related to the active landfill gas collection system required the removal of the fence. Throughout the construction period, a portable deodorizing system was employed to mitigate off-site odours.
- In 2010, the City completed an upgrade from a passive system to an active landfill gas collection system over a portion of the Site. The system reduced the quantity of methane released to the atmosphere and also reduced the odours generated at the Site. The active landfill gas collection system has been continuously active with the exception of occasional shutdowns required for system maintenance and repairs.

- In 2013, the City initiated programs, to further enhance management and mitigation of odours associated with the transport, management and disposal of biosolids, including:
    - The use of an odour neutralizing agent, which is applied to the biosolids at the water pollution control plants prior to delivery to the landfill site. Once the biosolids are tipped at the working face, they are mixed with other wastes and cover is applied. A hand held sprayer is also used by the vehicle operators to apply odour neutralizing agent to the empty trailers before they leave the Site;
    - Purchase of a portable odour fogging machine, which effectively distributes an odour neutralizing agent in the form of a light mist. The fogging machine is located at the active face and typically runs from the time the first load of biosolids arrives until after the last load has been received, tipped and covered;
    - Enhanced biosolids trailer washing to remove residual biosolids from the outside faces and wheels of the trailers; and
    - Replacement of mesh tarps with impermeable waterproof tarps on the biosolids trailers.
- The City has also completed a Class Environmental Assessment to identify a preferred long term biosolids management strategy. The objective of the study was to develop a sustainable and effective approach that reduces the impact on the City's landfill (ie: produce a material with beneficial uses), more effectively manages nuisance odours in transit and at the landfill site, has wide public support and is cost effective and environmentally responsible. In 2016 the City initiated the implementation phase to establish an alkaline stabilization or composting facility to process the biosolids. A facility is expected to be operational by 2019.

In addition to the foregoing the following are included in the operating protocols for the Site:

- Minimizing the size of the active area;
- Minimizing the storage time of waste prior to disposal within the active area;
- Appropriate management of leachate;
- Use of special practices for disposal of highly odorous waste; and
- Use of daily cover.

The City continues to be committed to a process of continual improvement in its odour management protocols. Their odour management program, will continue to include the on-going review of operational practices with potential for odour generation, completion of odour studies if necessary, formal response to odour complaints, and the implementation of capital improvements to reduce the potential impacts of odour.

Potential Effects and Mitigation:
The proposed project will consist of two activities that may have the potential to result in odour impacts: typical landfill operations (within new waste cells) and landfill mining.

- Typical Landfill Operations - Since the proposed activities associated with cell construction and typical landfill operations will not significantly increase the daily waste acceptance rate of the Site, nor will they adjust how waste deposition is conducted in the landfill, the odour profile (Frequency, Intensity, Duration, Offensiveness and Location) of the Site's operations is expected to remain the same. It is expected that the Site's existing odour management program would be able to effectively manage odour impacts associated with these activities.

- Landfill Mining - Landfill mining is proposed for the southwestern portion of the existing disposal footprint, as part of an environmental enhancement at the landfill to further mitigate the potential for groundwater impacts associated with unlined waste cells. The evaluation of alternative methods identified a preference for an expansion that included landfill mining, concluding that the shorter term odour effects and additional effort and cost to manage them was worth the opportunity to enhance groundwater management along the western site boundary. This conclusion was based on the experience of other landfill sites in North America where odour impacts were effectively managed through the implementation of best management practices. The proposed waste mining activities are expected to occur over a period of two years, up to five months each year.

  The mining process will involve the excavation of waste from a currently dormant area of the landfill and transfer of this waste to a lined cell. The mining process may include:

  - Screening of this waste to separate large and small factions;
  - Removal of recyclables or material with residual value; and,
  - Transfer of screened residual waste to a lined cell.

In developing the landfill mining program, the following will be completed:

- Draw upon the experience of other municipalities and landfill operators in setting up the waste mining process and detailed mitigation strategies;
- Complete a pilot mining program, to better characterize the type of waste, odour profile of the waste and logistical processes for screening and transfer to a lined cell;
- Use findings of pilot mining program to guide the development of Standard Operating Practices (SOPs) and the Odour Management Plan (OMP) for full-scale landfill mining;
- Engage local stakeholders to keep them abreast of the landfill mining process and gather their feedback on the process;
- Train all staff on SOPs and the OMP; and

- Conduct a monitoring campaign for odours around the landfill mining process.

In order to mitigate the potential for landfill mining to generate odour impacts, an OMP supplement will be developed specifically for this activity to support the site OMP. A preliminary version of the OMP supplement is included in **Appendix M**. The OMP will be finalized as the landfill mining program is designed and developed, and will include input from the contractor/landfill mining team and effective best management practices that have been implemented at similar sites. The OMP will be shared with the MOECC in preparation for the landfill mining activities.

Table 7.15 shows the linkage between some of the key planned odour management measures associated with the proposed landfill mining process and the MOECC recognized FIDOL approach for assessing/managing odours. It is anticipated that odour impacts from landfill mining can be managed through the practices described in **Table 7.15**, coupled with on-going engagement of the public.

The overall OMP for the Site will be enhanced to incorporate additional measures to mitigate potential impacts associated with the landfill mining process, and will become a 'living' document, requiring review and update as Site conditions change. The City is committed to making continuous improvement to reduce the sources of odours at the Site and along travel routes, and effectively manage and mitigate sources of odour that are inherent with typical landfill operations. Through the implementation of the odour management practices outlined above, and ongoing engagement with local stakeholders, it is expected that odours associated with the proposed landfill expansion can be effectively managed.

Table 7.15
SUMMARY OF ODOUR CRITERIA AND PROPOSED MANAGEMENT PRACTICES FOR LANDFILL MINING

Odour Assessment Criterion	Management Practices
Frequency	• Management of operations based on meteorological conditions (e.g., shut down during calm periods or specific wind direction) • Daily inspection program used to adjust and refine mining operations • Bypass screening of waste where highly odorous material is excavated
Intensity	• Use of chemical and biological treatment to reduce significance of odour • Use of periphery odour misting system • Minimize size of active excavation • Bypass screening of waste where highly odorous material is excavated
Duration	• Cover applied to excavated area at the end of the day • Daily inspection program used to adjust and refine mining operations • Bypass screening of waste where highly odorous material is excavated
Offensiveness	• Use of chemical and biological treatment to reduce significance of odour • Use of periphery odour misting system • Minimize size of active excavation • Bypass screening of waste where highly odorous material is excavated
Location	• Management of operations based on meteorological conditions (e.g., shut down when winds blowing to nearest receptors) • Daily inspection program used to adjust and refine mining operations

Table 7.16 summarizes the assessment of impacts for odour.

Table 7.16
ODOUR SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Ambient (baseline) air quality conditions.	There is potential for odour as a result of ongoing landfill operations.	The City will continue or initiate the following practices to minimize odour from landfill operations: • Minimizing the size of the active area; • Minimizing the storage time of waste prior to disposal within the active area; • Appropriate management of leachate; • Use of daily cover; • Use of odour neutralizing agent applied to the biosolids; • Use of a portable odour fogging machine to effectively distribute odour neutralizing agent at the site; • Enhanced biosolids trailer washing; • Use of impermeable waterproof tarps on the biosolids trailers; • Construction of a Biosolids Management and Processing facility; • Use of new fully sealed biosolids trailers in conjunctions with the Biosolids Processing facility implementation; and • Staged expansion of the landfill gas collection system.	Minimal net effects anticipated.
Ambient (baseline) air quality conditions.	There is potential for odour as a result of ongoing landfill mining.	In order to mitigate the potential for landfill mining to generate odour impacts, an Odour Management Plan (OMP) supplement will be developed. The OMP will be a 'living document' incorporating input from the contractor/landfill mining team, effective best management practices that have been implemented at similar sites, and ongoing input from site neighbours. It is anticipated that the odour management will include: • Completion of a pilot landfill mining program to characterize the type of waste and odour profile. Use of the information from this pilot to develop standard operating practices (SOP) for the full scale mining program.	

Table 7.16
ODOUR SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
		• Train all staff on the OMP and SOPs. • Management of mining operations based on meteorological conditions (e.g., shut down during calm periods or specific wind direction); • Daily inspection program used to adjust and refine mining operations; • Bypass screening of waste where highly odorous material is excavated; • Use of chemical and biological treatment to reduce significance of odour; • Use of periphery odour misting system; • Minimize size of active mining excavation; • Cover applied to mined area at the end of the day; • Keeping local residents informed and responding to complaints; and • Develop and implement a monitoring campaign for landfill mining.	

7.4 Economic Effects

The following describes the economic impact assessment completed for the preferred expansion option. Full details are provided in ***Appendices I and N***.

7.4.1 Businesses

Data Collection:

Primary and secondary sources were used to inventory the existing conditions as follows:

- *Secondary Information Gathering*: To gather information relevant to the study area, secondary source information was collected and reviewed. This was done using aerial mapping, street views of the roads within the study area (using Google Earth) and recording all businesses either adjacent to the road or at access and egress points. Further desktop research was conducted to gather descriptive information on the identified features using company websites, business directories and so forth.
- *Business Surveys*: A windshield survey was undertaken to identify businesses within 2 km of the proposed footprint. In addition, ten businesses within 1 km were identified for interview to determine current business operations and evaluate potential effects from both construction and operations phases of the Project. These businesses were selected for interview based on the type of service(s) they provided and also the presence of an outdoor component which may be affected by nuisance effects from the landfill. Seven businesses were available and were interviewed by telephone.

The study area for the business impact assessment was 2 km from the existing and proposed expansion fill area.

Existing Conditions:
The existing landfill site is situated between two gravel pits owned by Pioneer Construction Inc. and Ellwood Robinson Ltd. and opposite a campground on the south side of Fifth Line East. Generally the area is not commercialized; and the primary businesses are the large gravel/sand pits which cover large areas within the study area. There are 45 businesses within the 2 km study area as shown in **Figure 7.5**.

The seven businesses interviewed were well established businesses being in operation for at least 10 years. They all stated that they owned the business and land it was situated on.

When asked what things they liked about their business location, common answers from those surveyed included the proximity to nature, customers, the highway, and the city. Things that business operators disliked about the area included traffic, garbage trucks, noise and odour from the landfill, and poor road maintenance.

Respondents were asked about changes in the community since their business had been in operation. Positive changes included an increase in passing traffic resulting in more customers; while negative aspects included the economic downturn and decreasing number of American tourists. The loss of St. Marys Paper was also mentioned as a negative factor affecting the community in recent time as well as increased development resulting in a loss of natural environment.

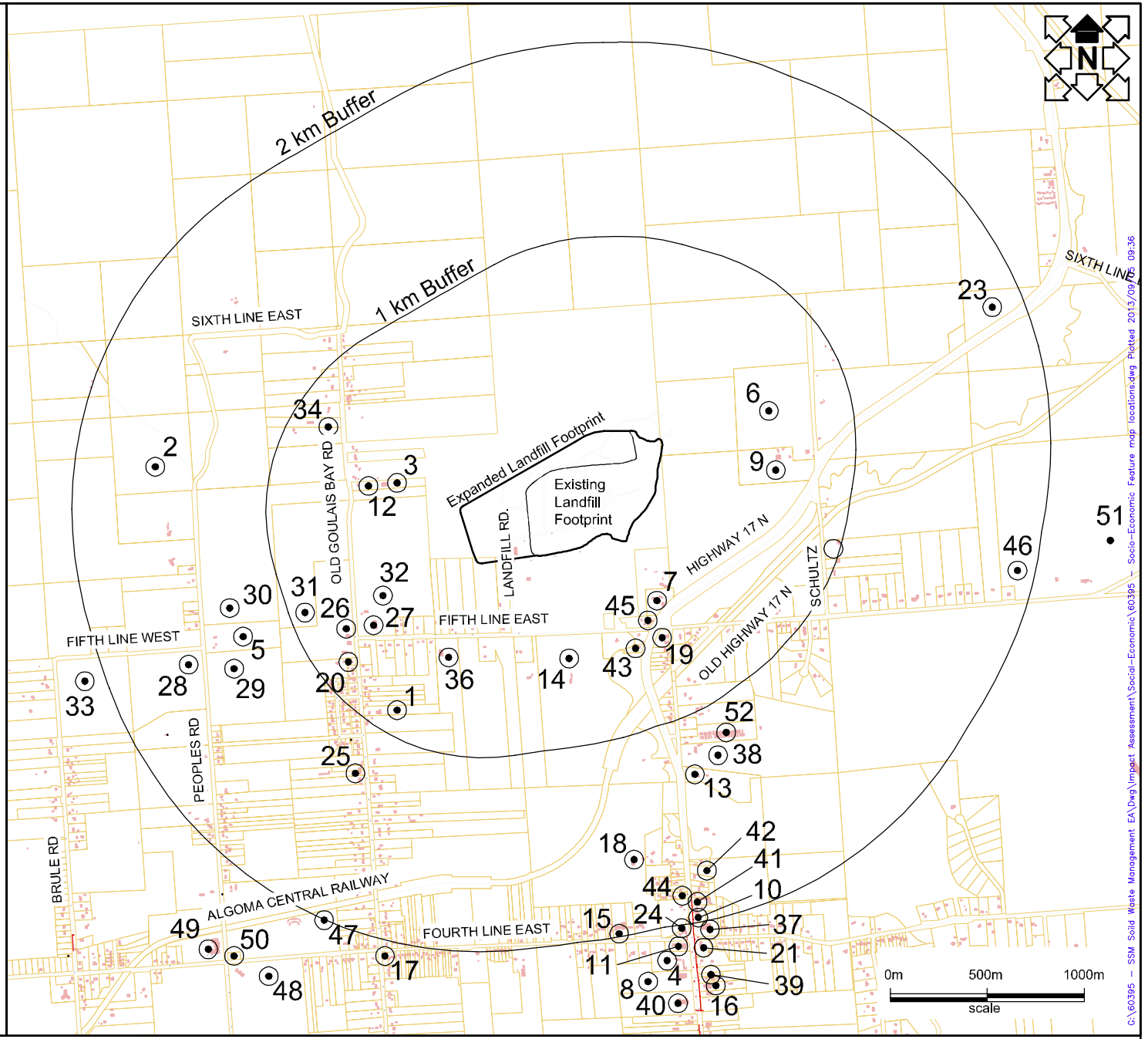
Potential Effects and Mitigation:
The proposed expansion will not result in any displacement of businesses.

Most of the businesses interviewed had an outdoor component that may be affected by factors such as noise or odour. Odour was mentioned by a number of survey respondents as an issue that affects the outdoor activity at their business. Only one business interviewed stated that they had considered moving from their current location; this was due to odour from the landfill which many customers had complained about.

Key concerns related to the landfill expansion were traffic (including trucks) and the capacity for existing roads to accommodate this traffic, odour and increased bears coming onto business properties.

Table 7.17 summarizes the assessment of potential effects of the proposed landfill expansion on businesses. Conclusions are based on survey findings and findings from other disciplines (odour and noise). Applicable monitoring programs and mitigation measures will be implemented to mitigate nuisance effects (above the existing conditions) for local businesses.

Feature #	Name
1	744 Auto
2	A. J. Positano Paving
3	Algoma Energy Solutions
4	Ambassador Motel
5	Andre's Auto Recyders
6	Brandes Gravel Pit
7	Caswell Concrete products
8	Construction Equipment Co.
9	Ellwood Robinson Limited
10	Esso Gas Station
11	Eternal Monuments
12	HET Heavy Equipment Technicians
13	Home on the Range Practise Facility
14	KOA Campground
15	Kresin Engineering Corporation
16	Lakeway Truck Centre
17	Maple View Inn
18	Maplewood Golf Course
19	Martin's trailers and Accessories
20	Maxoverdock computers
21	Monster Muffler
22	OMNI Global Ltd
23	Palmer Construction Group Inc
24	Perry's Great Northern Gun & Bow Shop
25	Pet Pleasure Resort
26	Pioneer Construction
27	Pioneer Construction Test Lab
28	Pioneer Construction Young Pit
29	Pioneer Construction McMillan Pit
30	Pioneer Construction City Pit
31	Pioneer Construction McQueen Pit
32	Pioneer Construction ? Pit
33	Pioneer Construction ? Pit
34	Possamai Construction & Aggregate
35	PUC Services Inc
36	Red Star Electric Contractors
37	Riuniti Banquet Halls
38	Root River Golf Club
39	Sims Custom Countertops
40	Toromont CAT
41	Trading Post And Frontier Village
42	Unidentified Quarry
43	WHAM Warren Hull's Asphalt Maintenance
44	Woody's Wheels
45	Vacant Commercial Property For Sale
46	Sault Ste. Marie Region Conservation Authority
47	Holy Sepulchre Cemetery
48	Greenwood Cemetery
49	Greenwood Public School
50	East Korah Maxwell United Church
51	Hiawatha Highlands
52	Root River Trailer Park



AECOM Canada Ltd.
523 Wellington Street East, Sault Ste. Marie Ontario, Canada
P6A2M4 T705.942.2612 F705.942.3642

Sault Ste. Marie Municipal Landfill Site
Socio-Economic Features

Figure 7.5

Table 7.17
BUSINESS SUMMARY OF NET EFFECTS

Indicator	Potential Effects	Proposed Mitigation	Net Effects
Presence of business enterprises on site, off site, in the vicinity of the current or potential site and along the access route(s).	There are no businesses on-site and thus no displacement of businesses is anticipated.	No mitigation required.	No net effects anticipated.
	Business survey data suggests that businesses felt their operations could be affected by a downturn in customers related to increased nuisance effects such as noise or odour as well as traffic levels making routes to businesses dangerous and more difficult for customers. Overall, no significant increase in noise or traffic and thus impacts are not anticipated from the proposed landfill expansion assuming appropriate mitigation.	• Construction of the proposed on-site berm to shield noise generating activities at the composting pad. • Refer to odour mitigation below. • Traffic monitoring is proposed including traffic counts and accident reviews.	Minimal net effects anticipated.
	Some additional odour is likely during landfill mining.	Section 7.3.7 provides a complete outline of odour mitigation and includes: • Continuation of current operational practices to reduce odour; • Best management practices for odour managed during landfill mining including development and implementation of an Odour Management Plan; • Construction of a Biosolids Management and Processing facility; • Staged expansion of the landfill gas collection system; and • Keeping local businesses informed of landfill mining timing and duration.	Minimal net effects anticipated
	Concerns regarding increased numbers of bears were raised by 2 of 7 businesses interviewed.	A vermin management plan will be developed and detailed in the Design and Operations report.	No net effects anticipated.

7.4.2 Transportation

Data Collection:

The traffic impact assessment examines and evaluates the potential for impacts on transportation infrastructure/networks associated with the landfill expansion. The assessment was completed with consideration of existing and historical traffic volumes, projected traffic growth related to future landfill operations, traffic growth related to landfill site development activities and the most recent update to the City's Transportation Master Plan. The potential disruption effect on local residents and businesses is evaluated as part of the socio-economic assessment.

For the purposes of the detailed impact assessment, the "on-site study area" is defined as lands within the preferred landfill footprint (existing and expansion areas). The "site vicinity study area" extends along Fifth Line to Old Goulais Bay Road to the west and Highway 17 north to the east. The site vicinity study area includes the Fifth Line intersections with Highway 17 north and Old Goulais Bay Road.

Data collection included:

- A review of historical traffic volumes and accident history.
- Traffic counts completed over 6 days from May 17, 2014 to May 22, 2014.
- An 8 hour intersection traffic count at the Fifth Line/Highway 17 intersection on Tuesday, September 15, 2015 and Wednesday October 28,1998.

Existing Conditions:

Access to the municipal landfill site is provided via Fifth Line, an east-west traffic corridor near the City's northern Municipal boundary with intersections at Old Goulais Bay Road and Highway 17 North. Fifth Line is Class B truck route and classified as a local road. It provides limited mobility as a thoroughfare as it terminates at a "T-intersection" to the west of the landfill at Old Goulais Bay Road. Old Goulais Bay Road, to the north of Fifth Line, dead ends and transitions to a trail some 1.6 km north of Fifth Line. In addition to the landfill site, Fifth Line also services area residents along Fifth Line and Old Goulais Bay Road, several local businesses, KOA campground and it is an important truck route for Contractor's yards and aggregate extraction operations in the Fifth Line/Old Goulais Bay Road area. Both intersections in the site vicinity study area operate with stop control along Fifth Line.

Posted Speed and Road Geometrics – Posted speeds on Old Goulais Bay Road, Fifth Line and Highway 17 in the site vicinity study area are 50 km/h, 60 km/h and 80 km/h respectively. Fifth Line has a tangential alignment throughout the site vicinity study area and the road grades are generally "flat" with the exception of the Fifth Line grade on either side of Root River where the maximum grade is in the range of 6% and 8% respectively.

Historical Traffic Volumes - The Fifth Line traffic volumes have remained stable and have historically been in the range of 1,200 to 2,300 vpd between 1998 and 2015. Peak hourly two way traffic volumes have slightly exceeded 200 vehicles per hour.

Based on an eight hour intersection traffic count on September 15, 2015, at the Fifth Line/Highway 17 intersection, the hourly two way traffic volumes on Fifth Line west of Highway 17 ranged from 111 to 137 vph. During the same period the number of hourly left turns from Highway 17 to Fifth Line ranged from 18 to 41 vph and the right turns from Fifth Line to Highway 17 ranged from 24 to 49 vph (i.e. very similar to the left turn movements from Highway 17 to Fifth Line). Other turning movements to and from Highway 17 were much less significant as the majority of vehicle trips are to and from the City center located to the south.

This count was compared to a similar count completed in 1998. The volumes in 1998 were moderately higher relative to the volumes presented in the preceding paragraph for 2015 which highlights the consistency in traffic volumes over time.

Accident History – The accident history within the site vicinity study for the period spanning from January 1, 2008 to March 30, 2013 (ie. 5 ¼ years) is shown in **Table 7.18**.

Table 7.18
ACCIDENT HISTORY IN SITE VICINITY

Location	Total Number of Accidents	Average Annual Accident Rate
Fifth Line/Highway 17 N intersection	11	2.1
Fifth Line (Highway 17 N to Old Goulais Bay Road)	1	0.2
Fifth Line/Old Goulais Bay Road intersection	3	0.6

Pedestrians and Cyclists - There is anecdotal evidence of modest pedestrian/cyclist traffic along this route. A total of zero and seven pedestrian crossings were recorded during the Fifth Line/Highway 17 N eight hour intersection traffic counts undertaken in 2015 and 1998 respectively. Pedestrians are currently accommodated on shoulders adjacent to the roadway and cyclists are either accommodated within the travel lane or along the partially paved shoulders. The accommodation of pedestrians along shoulders is consistent with the City's approach along other rural road corridors in the City and in this instance the traffic volumes are modest relative to other traffic corridors with a similar road cross section.

There are no identified cycling destinations within the site vicinity study area and Fifth Line is not identified as a significant cycling corridor (i.e. Part of Hub Trail or spoke route) within the 2007 Cycling Master Plan Update.

Projected Traffic Volumes - No significant increase in traffic is anticipated as a result of the proposed landfill expansion, population growth or other land development activities in the vicinity of the site. The City has developed mapping illustrating potential residential and Industrial, Commercial & Institutional (IC&I) growth areas over the next 20 years and no potential development sites have been identified in the vicinity of the landfill site.

The City has also recently completed an update to their Transportation Master Plan. There are no references to any significant changes in traffic patterns/volumes in the site vicinity study area nor are there any specific upgrades or improvements referenced for the Fifth Line corridor within the site vicinity study area.

The overall increase in traffic associated with site development activities and increased site visits associated with population growth is expected to be very modest throughout the planning period as summarized below.

Potential Effects and Mitigation:
Population projections have been developed in conjunction with the Environmental Assessment process. The projections have been developed based on the most recent work (i.e. 2015) completed by the City's Planning Division.

Based on these projections, it is anticipated that the population within the service area may increase to 87,200 by 2055.

Based on the weigh scale records for the site for the period from 2010 to 2013 inclusive the estimated average annual number of trips to the site is in the range of 63,000 to 75,000 with an average of 69,400 over the 4 year period. This translates into an average annual daily traffic volume of approximately 500 vehicles per day.

Assuming that the number of visits to the site will grow in proportion to the population increases there may be in the order of 80 additional vehicles per day on Fifth Line by 2055.

In addition to an increase in customers visiting the site, there are a total of eight development sequences for the proposed expansion which will require construction activity. Typically the construction activity will be undertaken in the spring through fall periods and the level of construction traffic accessing the site will vary considerably during this period. It is anticipated that the activity that will generate the most traffic to and from the site will be the delivery of granular materials for the cell liner construction. The maximum estimated rate of deliveries is five round trips per hour over an 8 hour period. This may increase the average annual daily traffic volume in the range of 80 vehicles per day. The impact may be reduced if existing trucks that currently haul granular materials from nearby aggregate extraction operations are routed to the landfill site in lieu of other projects.

Based on the forgoing, projected traffic volumes are expected to remain below 3,000 vehicles per day along Fifth Line. A standard two lane roadway can typically accommodate average annual daily traffic volumes in the range of 15,000. Thus, no significant capacity related impacts are anticipated.

The intersections within the site vicinity study area are operating effectively with acceptable levels of service and no significant impacts are anticipated with the projected modest increased traffic volumes.

Fifth Line was last upgraded by the City in 1990 and is currently in good condition with a 2014 condition rating of 81 out of 100. The roadway has been designed to accommodate heavy truck traffic and includes 80 mm of asphalt. No significant impacts are anticipated to the road structure integrity as a result of the modest increase in traffic volumes that will be routed along Fifth Line to access the expanded landfill site.

The projected modest growth in traffic associated with construction activities and increased site visits is not anticipated to result in any traffic safety concerns or significant impact on pedestrian and cyclist safety and mobility relative to current conditions.

As traffic impacts are not anticipated, no specific mitigating measures are required at this time. **Table 7.19** summarizes the potential traffic impacts and identifies proposed monitoring to ensure the predicted effects are not exceeded.

Table 7.19
TRAFFIC SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Traffic safety along access route(s).	The projected modest growth in traffic associated with construction activities and increased site visits is not anticipated to result in any traffic safety concerns or significant impact on pedestrian and cyclist safety and mobility relative to current conditions.	In order to address the reported near misses observed by area residents at the Fifth Line/Highway 17 intersection sight line improvements and a detailed review to confirm the suitability and adequacy of warning signage are recommended. Enhancements to the road geometrics should also be considered in conjunction with the next capital improvement project along the Highway in this area. In addition the following monitoring is suggested: • Review accident history every 5 years and identify high risk road segments or intersections. • Monitor vegetation growth within the right-of-way and maintain maximum sight lines.	No net effects anticipated.

Table 7.19
TRAFFIC SUMMARY OF NET EFFECTS

Indicator	Potential Effect	Proposed Mitigation	Net Effect
Traffic operations along access route(s)	No significant capacity related impacts, intersection impacts or roadway condition issues are anticipated.	No mitigation required. However the following monitoring is suggested: • Conduct 24 hour traffic counts over a period of several days along Fifth Line to the east and west of the landfill entrance and confirm adequacy of the lane configuration every 5 years. • Conduct 8 hour intersection traffic count at the Fifth Line/Hwy 17N intersection to confirm adequacy of the level of service, lane configuration and intersection controls as needed based on volume. • Continue to complete road condition assessments and schedule maintenance/ repairs/upgrades as required in accordance with the City's Road Management Plan.	No net effects anticipated.

7.5 Consideration of Cumulative Effects and Climate Change

Cumulative Effects

The assessment of cumulative effects is not a requirement stipulated in the *Environmental Assessment Act*. However consideration of cumulative effects is one of MOECC's Statement of Environmental Values. Consideration of whether there is a cumulative impact from the proposed expansion and other activities requires consideration of the following:

- To act cumulatively, the proposed landfill expansion must have adverse net effects on the environment.
- Other activities that have the potential to cause effects on the environment have to be taking place in the vicinity of the proposed landfill expansion.
- Other activities have to be taking place at the same location as the proposed landfill expansion such that potential effects from both projects overlap.

Based the impact assessment carried out for the landfill expansion, no significant adverse net effects on the natural, social or economic environments are anticipated assuming implementation of the proposed mitigation. The following are other known projects being undertaken in the vicinity or within a similar time frame as the proposed landfill expansion:

- The City of Sault Ste. Marie Biosolids facility will be constructed at the landfill. Its construction will not overlap with the proposed landfill expansion as it is anticipated to be complete by 2019. As biosolids are currently brought to the site for disposal, the change that will result from operation of the new facility is anticipated to be positive as processing will reduce odour.

Based on the assessment of effects completed through this EA and an understanding of the other projects as noted above, no negative cumulative effects are anticipated.

Climate Change

Ontario's Climate Change Action Plan released in June 2016 identifies the Province's intention to work with the waste sector to capture greenhouse gas pollution that would otherwise be released to the air.

The City has been proactive in its effort to mitigate anthropogenic climate change with an upgrade from 30 vent flares to an "active" landfill gas collection system at the landfill site in 2010. The system reduces the quantity of methane released to the atmosphere (i.e. reduces the carbon footprint of the site) and also reduces odours generated at the site.

The City remains committed to mitigating impacts to climate change in conjunction with the proposed landfill expansion project. The existing landfill gas collection system will be expanded incrementally as the site develops to provide effective landfill gas collection across the site. Although the collected gas is currently being flared, the City, though its subsidiary, PUC Services Inc. has completed a comprehensive feasibility study and business case to utilize the collected gas for electricity generation. PUC Services Inc. remains committed to moving forward with an electricity generation project if suitable incentives become available to support the business case.

Climate change adaptation was also considered in the development of the proposed landfill expansion. The City of Sault Ste. Marie completed a Stormwater Master Plan and Guidelines document in 2015 which considered the possible impacts of climate change on drainage systems and stormwater best management practices. The proposed landfill expansion was designed in accordance with this guideline document.

8.0 IMPACT MANAGEMENT

The undertaking has been designed to incorporate mitigation to enhance existing environmental conditions associated with the existing site and minimize the potential for negative environmental effects. However, it is recognized that some residual effects may occur. In the previous chapter each of the technical disciplines involved in the EA identified measures to minimize potential negative effects of the proposed expansion through design, construction and operation practices. It will be important to monitor the implementation of these mitigation measures and adjust as necessary. This chapter of the EA summarizes the proposed mitigation measures, identifies how they will be monitored, and establishes contingency measures in the event that monitoring identifies unexpected impacts. Also included is a commitment to ongoing discussions related to the proposed landfill expansion with the local community.

8.1 Mitigation Measures

In Chapter 7, each of the technical disciplines identified potential impacts associated with the proposed landfill expansion and measures to mitigate these potential negative impacts. A summary of the issues raised and the mitigation proposed, is included in **Table 8.1** (at end of Section 8.0). The proposed mitigation was presented for public review at the final public open house for the project on February 9, 2016. The mitigation measures in this table will be implemented through the design, construction and operation of the proposed expansion.

8.2 Monitoring

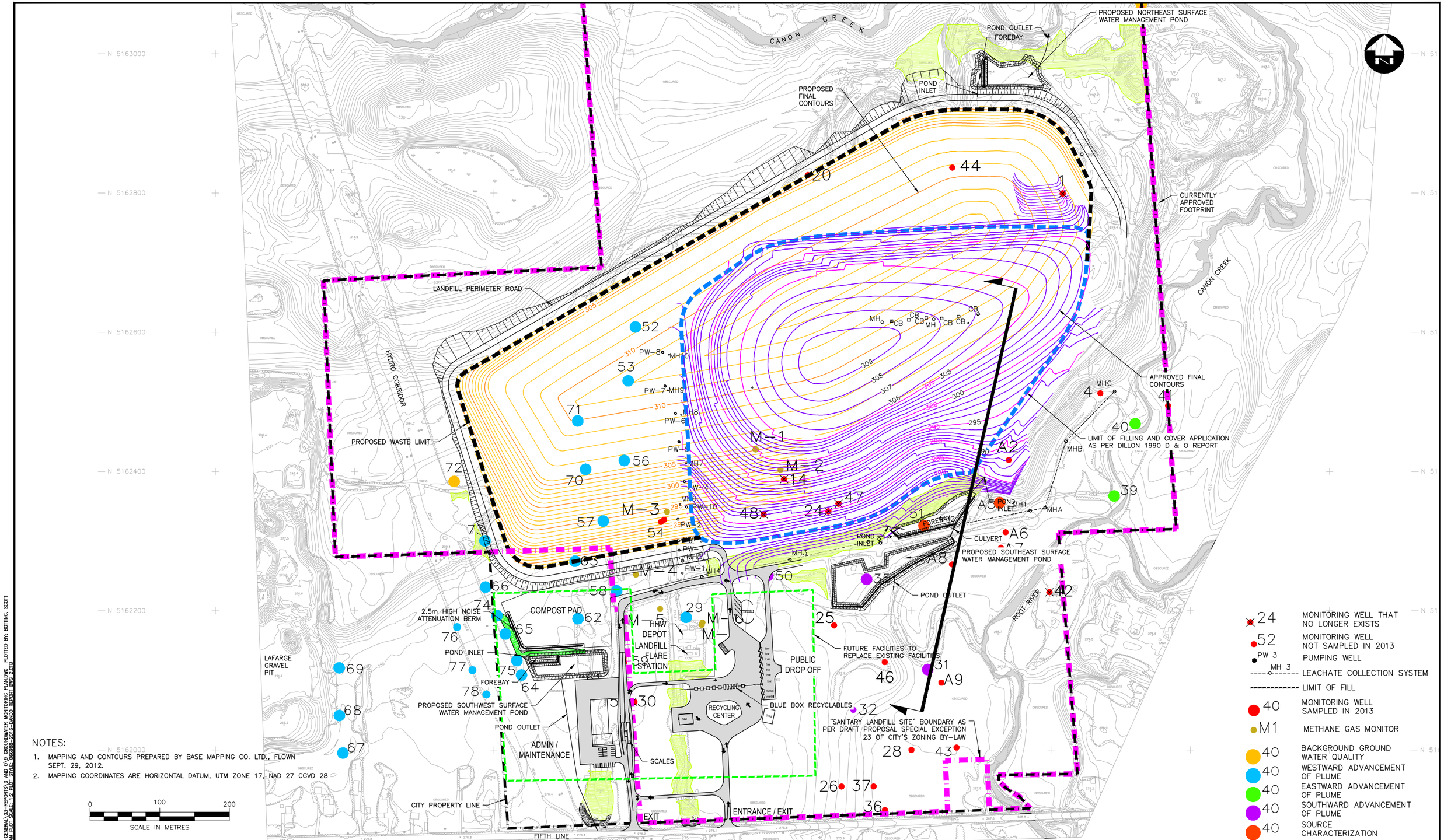
Effective monitoring is needed to confirm the impacts predicted through this EA and to confirm that mitigation is in place and operating effectively. Monitoring will be undertaken for groundwater, surface water, and landfill gas. Monitoring of the commitments made in the EA related to the mitigation of potential effects will also be completed. The following subsections describe the proposed monitoring programs.

8.2.1 Ground Water Monitoring

The ground water monitoring program for the proposed expansion will utilize existing monitoring wells. Currently, there are 39 ground water monitoring wells in the existing sampling program that were chosen for their strategic locations and potential to detect changes in ground water chemistry as a result of leachate generation in the refuse.

The monitoring wells provide data on source (leachate) concentrations, background concentrations and provide ground water quality data downstream of the fill area. Additional replacement monitoring wells will be required as existing wells are decommissioned as a part of the design of the landfill expansion. The locations of the existing ground water monitoring wells that are available as well as proposed new monitoring well locations are shown on **Figure 8.1**. Ground water monitoring wells are selected to provide sufficient chemical information to evaluate the impact of the landfill

site on ground water quality. Ground water samples will be collected in the spring, summer and fall which is consistent with the existing landfill monitoring program. Ground water elevations for all accessible monitoring wells on-site will be obtained in conjunction with ground water sampling events. Ground water samples will be analyzed for general chemistry, major and minor ions, trace metals and volatile organic parameters as recommended in Schedule 5 of O.Reg. 232/98.



NOTES:

1. MAPPING AND CONTOURS PREPARED BY BASE MAPPING CO. LTD., FLOWN SEPT. 29, 2012.
2. MAPPING COORDINATES ARE HORIZONTAL DATUM, UTM ZONE 17, NAD 27 CGVD 28

0 100 200
SCALE IN METRES

- 24 MONITORING WELL THAT NO LONGER EXISTS
- 52 MONITORING WELL NOT SAMPLED IN 2013
- PW 3 PUMPING WELL
- MH 3 LEACHATE COLLECTION SYSTEM
- LIMIT OF FILL
- 40 MONITORING WELL SAMPLED IN 2013
- M1 METHANE GAS MONITOR
- 40 BACKGROUND GROUND WATER QUALITY
- 40 WESTWARD ADVANCEMENT OF PLUME
- 40 EASTWARD ADVANCEMENT OF PLUME
- 40 SOUTHWARD ADVANCEMENT OF PLUME
- 40 SOURCE CHARACTERIZATION

Conditions of Use

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Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

AECOM

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY
1	SUPPLEMENT TO EA REPORT	2015/03/31	F.R.G.

DESIGN F.R.G.	REVIEWED BY F.R.G.
DRAWN D.B.C./S.K.B.	CHECKED BY F.R.G.
DATE MARCH 2015	
SCALE	

SAULT STE. MARIE MUNICIPAL LANDFILL SITE
HYDROGEOLOGICAL IMPACT ASSESSMENT REPORT

PROJECT NO. 06-6988

GROUNDWATER MONITORING PLAN

FIGURE NO. 8.1

FILENAME: G:\CAD\06688 SSM EA\00-GENERAL\03-REPORTS\D AND D\9 GROUNDWATER MONITORING PLAN.DWG PLOTTED BY: BOTTING, SCOTT
PLOT DATE: 2017-03-17 @ 11:08:56 AM PLOT SCALE: 1:2 PLOT STYLE: 06688-2016-DANDO REPORT DWG 2.CTB

8.2.2 Surface Water Monitoring

Surface water quality samples are obtained and analysed to provide a general assessment of the surface water quality conditions near the Sault Ste. Marie Municipal Landfill site. The existing surface water monitoring program includes the collection of water samples at five of the eight sampling points along Canon Creek and the Root River. These sampling points are located upstream, adjacent to and downstream of the landfill and are described below and shown on **Figure 8.2**. The samples collected are analysed for general parameters, nutrients, mercury and trace constituents (metals and phenols). The target surface water parameter list is based on that recommended in O.Reg. 232/98.

Station	Description
S-IB	Canon Creek upstream (currently active)
S-2	Root River upstream (currently active)
S-3	Canon Creek adjacent to the landfill site (currently active)
S-4	Meander area (currently active)
S-5	Root River downstream (currently active)
S-8	Root River at Highway 17
S-9	Root River at Fourth Line
S-10	West Branch of Root River at confluence with East Branch.

No new monitoring locations are required for surface water monitoring at the site since the landfill expansion will not result in proximity to any new surface water that isn't already part of the existing surface water monitoring program.

8.2.3 Landfill Gas Monitoring

Methane gas is produced as a result of biodegradation of waste. The absence of a low permeability cap on the landfill facilitates the venting of methane gas directly from the waste to the atmosphere. During frozen ground conditions, a build-up of gas pressure will likely occur within the landfill. This could cause the lateral migration of methane gas in the sand and gravel deposits surrounding the waste. The methane gas will migrate until:

- It is able to vent to the atmosphere;
- The pressure gradient is reduced at a distance from the source such that lateral migration is negligible; or
- An effective barrier is encountered.

The water table is known to be an effective natural barrier for methane gas (since methane gas is relatively insoluble in water). Therefore, Canon Creek will effectively retard the lateral migration of methane gas along the north and east boundaries of the fill area. Southern migration of gas will be limited by the high water table in the meander area.

S-1B
S-1A
Canon Creek
Root River
Contaminant Attenuation Zone
Landfill
S-10
S-2
S-3
Root River
S-4
S-5
Fifth Line West
Site Entrance
Highway 17
S-8
S-9

Conditions of Use

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AECOM

DILLON CONSULTING

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1	SUPPLEMENT TO EA REPORT	2015/03/31	F.R.G.

DESIGN F.R.G.	REVIEWED BY F.R.G.
DRAWN D.B.C./S.K.B.	CHECKED BY F.R.G.
DATE MARCH 2015	
SCALE	

SAULT STE. MARIE MUNICIPAL LANDFILL SITE
HYDROGEOLOGICAL IMPACT ASSESSMENT REPORT

PROJECT NO. 06-6988

SURFACE WATER MONITORING PLAN

FIGURE NO. 8.2

FILENAME: G:\CAD\06-6988 SSM EA\00-GENERAL\03-REPORTS\D AND O\10 SURFACE WATER MONITORING PLAN.DWG PLOTTED BY: BOTTING, SCOTT
PLOT DATE: 2017-03-17 @ 11:09:14 AM PLOT SCALE: 1:2 PLOT STYLE: 066988-2016-PANDO REPORT DWG 2.CTB

The monitoring program currently consists of measurements of gas in five gas monitors (M3, M4, M5, M6 and M7) the locations for which are shown in **Figure 8.1**. These locations have been selected based on their proximity to on-site infrastructure and buildings. Due to the proximity of the proposed expansion to the western site boundary and the proposed redevelopment of some of the site infrastructure and buildings new methane monitors may be required and the need for and location of new methane monitors will be assessed during final landfill design.

8.2.4 Landfill Mining Monitoring

As noted in Section 7, the City will draw on the experience of other municipalities and landfill operators and set up a pilot mining program to gather the information required to establish the waste mining process and detailed mitigation strategies. An important part of the pilot will be the monitoring of odours during excavation and processing of mined waste. An odour monitoring program for full scale landfill mining will be prepared using the data collected from the pilot. Input and complaints from the public will also be valuable in the ongoing odour monitoring.

8.2.5 Residential Well Water Monitoring

Municipal water currently extends north along Old Goulais Bay Road and then east along the Fifth Line to the landfill site. Residences and businesses east of the landfill site are on private wells and some residences and businesses west of the site may also continue to use private wells.

A residential water well monitoring program will be implemented as part of the landfill expansion. While there is no guideline on how water wells are chosen to be included in a monitoring program, a 500 m “rule of thumb” is often used for landfill sites, quarries and other land uses/activities that may impact residential water well quality. Residences along Fifth Line from Highway 17 to about 400 m east of Old Goulais Bay Road are within 500 m of existing or proposed fill areas. It is recommended that the residential water well monitoring program extend along Fifth Line from Highway 17 in the east to Old Goulais Bay Road in the west. There are some residences on Old Goulais Bay Road northwest of the landfill which are slightly more than 500 m from the northwest corner of the westerly expansion area. Given that groundwater does not flow in a northwest direction, it is not considered necessary to monitor residential water wells in this area.

The first component of the water well monitoring program will be a water well survey consisting of a questionnaire that will be provided to residents with questions regarding their well such as location, depth and existing water quantity or quality issues. It will also ask if the residence wants to be included in the water well monitoring program. For those residences who volunteer to have their well included in the monitoring program, a baseline water well assessment is recommended. The water well assessment will be completed by a licensed Water Well Contractor under Reg. 903 who will document the depth and type of well at each location. Where possible this information will be correlated with Water Well Records. The Ontario Water Well Record database is

incomplete and location information is prone to error but efforts will be made to match well information to available water well records.

Water samples from the residential wells included in the monitoring program will be taken on an annual basis. Where possible, samples will be taken from the wells prior to any treatment systems such as water softeners. Water samples will be analyzed for the parameters included in the indicator and comprehensive list of Schedule 5, of the Landfill Standards (the same target parameter list for on-site monitoring wells).

Should the landfill be shown to impact private wells, contingency measures to ensure residents have clean drinking water would include extension of the municipal water system to residents east of the site, or the provision of alternative water supplies to adjacent and nearby affected properties.

8.2.6 Transportation Monitoring

Traffic volumes and accident rates will continue to be monitored periodically by the City over time. Counts will be undertaken once every five years and more frequently if a need or problem arises. The counts will include volume counts on Fifth Line to the east and west of the landfill entrance and will also include an 8 hour intersection traffic count if the Fifth Line counts reflect meaningful changes. These counts will be reviewed in conjunction with the accident rates within the site vicinity study area to assess and confirm the adequacy of the basic lane and intersection configurations and controls relative to the standards of the day.

The road structure and riding surface will continue to be assessed by the City every two years. Consideration will be given to upgrading the road once the condition rating falls near or below a condition rating of 40.

The City will also review the need for clearing activities in the vicinity of the Fifth Line/Highway 17 intersection on an as needed basis to ensure sight lines are maintained.

8.2.7 EA Commitment Monitoring

The City of Sault Ste Marie has committed to a number of mitigation measures as documented in **Table 8.1** This table identifies the mitigation and the proposed timing for the mitigation (e.g. during design, construction or operation). The implementation of the mitigation measures will be monitored to make sure that measures are being put in place as proposed and that they are addressing the potential impact. Annual reporting on the monitoring of EA commitments will be submitted to MOECC through the monitoring and site development and operations report.

8.2.8 Resident Complaint Monitoring

The City has implemented and will continue to operate a complaint procedure with the goal of continual improvement in its nuisance management and mitigation. Property owners within 500 m of the expanded disposal footprint will be provided with contact

information and details for registering complaints. This information will be forwarded to area residents in an annual notice. The Notice will be issued in January of each year and will also highlight any special landfill activities or projects that are planned in the current year. The Notice will also be posted in the local newspaper and on the City's website.

All pertinent information is recorded by the staff member documenting the compliant to ensure the best possible approach is taken to mitigating the nuisance.

8.3 Contingency Measures

The development of contingency measures acknowledges that there is a degree of uncertainty in estimating potential impacts and that unexpected effects could occur. A contingency plan is required by O.Reg. 232/98 and defined as "an organized set of procedures for identifying and reacting to an unexpected, but possible occurrence" (MOECC, 2012). The contingency plan consists of a predictive monitoring program, establishing trigger levels for investigation and response and a description of potential contingency measures.

While the new landfill system is predicted to have maximum impacts below allowable Reasonable Use Guideline (RUG) concentrations ground water contingency measures are proposed as follows:

- Maintenance and replacement, if necessary, of the existing horizontal collection system on the south and east sides of the existing site. The horizontal collection system is located beyond the fill area and can be maintained or replaced if necessary throughout the contaminating lifespan of the existing fill area.
- Extension of the municipal water system to the residents located along Fifth Line east of the site to Highway 17 or the provision of alternative water supplies to adjacent and nearby affected properties if monitoring data indicates the potential for water quality impacts (i.e. does not meet provincial drinking water standards).
- Establishment of an extended contaminant attenuation zone (CAZ) down gradient of the proposed expansion. This would include lands that currently consist of a hydroelectric transmission corridor immediately west of the site with an aggregate extraction pit down gradient of the transmission line.
- Installation of a new north-south horizontal groundwater collector system installed within the expansion area or a new purge well system west of the expansion area to provide groundwater protection to the area west and southwest of the new fill area

For surface water, the four new SWM ponds incorporated into the proposed expansion design will be designed with emergency flow control systems at their outlet, as a contingency. The SWM ponds can act as emergency response cells where runoff can be stored in case of surface water contamination by leachate or onsite spills.

Emergency response could be assisted by consideration of a program of regular inflow monitoring of indicator parameters (possibly including Oil and Grease, Conductivity, pH and TDS) to trigger a manual shutdown response using either a control valve or gate. The ponds will be lined and designed to retain the complete runoff from the 1:100 year rainfall until appropriate treatment can be applied. The contaminated runoff will either be treated and discharged to the receiving watercourse or pumped and hauled for treatment elsewhere.

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
BIOLOGY		
Removal of on-site trees and ground vegetation.	Minimize removal of trees to the extent possible. General tree protection and edge management practices are recommended to minimize the physical disturbance associated with vegetation removal. These include: • Remove and dispose of waste pile and inorganic debris. • Use qualified professional for tree removal. • Trees located along new woodland edge that may conflict with construction activity should be pruned by a qualified professional. • Where feasible, select felled logs and other organic debris should be placed carefully in existing forest. • Small trees, shrubs and ground vegetation immediately adjacent to clearing area should be preserved. • Tree protection fencing should be installed around critical root zone of preserved trees. The fencing should be monitored and maintained throughout construction. • Heavy machinery should be avoided within the root zones of the adjacent trees to prevent soil compaction and root damage. • Avoid placing fill in periods of high run-off (e.g. spring and fall) to prevent deposition of sediment in tree root zones. • If excavation is required near the forest edge, an arborist should expose the root system to determine where root pruning is required. • Use of core aerators should be considered where appropriate to improve aeration and drainage of compact soils near forest edge. • Woodland edge should be inspected periodically during construction for indicators of tree dieback. If observed a condition assessment should be completed by a qualified arborist. • Within 12 months of each stage of landfill expansion, a qualified arborist should assess the new woodland edge and conduct removal or pruning as required.	Detailed Design Site Preparation and Construction
Potential introduction of exotic and/or	• The potential impact of invasive species can be largely mitigated through	Site Preparation and

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
invasive flora species to the surrounding vegetation communities.	the implementation of an edge management plan (see points above). • Select removal should occur in areas heavily invaded by invasive exotic species.	Construction
Localized edge disturbance and/or loss of adjacent vegetation along Root River/Canon Creek due to the deposition of dust and/or overland mobilization of soil.	Mitigation for erosion and sediment control includes: • Silt fencing or a reasonable alternative should be installed on the edge of the development limits and grading limits. • Mud Mat should be installed at the construction entrance. • Rock Check Dams and/or Filter Socks in swales and ditches. • Removal of any accumulated sediments. • Surface stabilization for stockpiles and temporary sediment basins. • Erosion control blankets may be required for sloped restoration areas regardless of timing.	Site Preparation and Construction
Potential impacts to aquatic habitat resulting from landfill leachate.	• Ongoing operation of leachate collection system. • Ongoing stormwater monitoring.	Operation
Potential for incidental wildlife mortality on-site primarily attributed to vehicle collisions.	• Vegetation removal should not take place during established core breeding bird season (i.e. May 9th to August 8th). • Where appropriate retain wildlife habitat trees that contain nest, den or roost cavities. • Avoid construction lay-down and staging within the boundary of a natural feature scheduled for preservation.	Site Preparation and Construction
Disturbance to off-site local wildlife communities due to operational noise, light, vibration and human presence that can adversely influence movement, population size and breeding success of local wildlife.	• Where possible maximize the distance of construction equipment from the woodland edge. • Limit the use of lighting where possible. • Advise contractor and construction staff through drawing specifications and awareness training to visually monitor wildlife species and report encounters.	Site Preparation and Construction
HYDROGEOLOGY		
Ability to manage leachate to meet appropriate criteria and have minimal groundwater impacts during the service life of the engineered systems.	• Engineered liner and leachate collection system for the new fill area. • Landfill mining of the western portion of the existing site and addition of an engineered liner and leachate collection system. • New horizontal groundwater collection system or purge wells on the western edge of the new fill area (contingency measure).	Construction Landfill Mining Operation

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
	• Continued operation of the existing horizontal collection system along the south and southeast boundary of the existing fill area to maintain mitigation of impacts to the south and east of the site. • Continuation of the groundwater monitoring program.	Operation Ongoing During Operation
Protection of important areas identified in the Sault Ste. Marie Region Source Water Protection Plan (SPP) including municipal wellhead protection zone, Medium Vulnerability Source Water Protection Area and Significant Groundwater Recharge Area.	• With landfill mining and the placement of a liner in the mined and new fill areas, additional ground water protection will be provided at the site. • The SPP requires City to protect these areas through their Official Plan policies. The proposed expansion complies with these policies. • Work completed as part of this EA shows the site is predicted to meet appropriate criteria and have minimal impacts assuming mitigation is incorporated into the design as noted above. • The SPP requires approval under the *Environmental Assessment Act* and *Environmental Protection Act* to demonstrate that the expansion does not pose a threat to the aquifer and drinking water. • Ongoing groundwater monitoring will take place at the site. • New horizontal groundwater collection system or purge wells on the western edge of the new fill area (contingency measure).	Detailed Design Operation
Potential for impact on private wells for property owners along Fifth Line east of the landfill who source potable water from private wells and some property owners along Fifth Line west of the landfill and Old Goulais Bay Road south of Fifth Line who have access to municipal supply but may still continue to source potable water from private wells.	• The City will implement a residential well water monitoring program (see Section 8 for more details on this program). Should impacts be detected extension of the municipal water system could be completed or alternative water supplies provided.	Operation
SURFACE WATER		
Potential water quality impact from leachate or spills.	• Stormwater will be directed to lined stormwater management (SWM) ponds.	Detailed Design

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
	• Downstream surface water receivers will be monitored as per current practice.	Operation
Potential water quality impact from total suspended solids (TSS).	• The SWM ponds will be designed to remove 80% TSS.	Detailed Design
Potential for stormwater to result in thermal impact to Root River which is a cold water fishery.	• The SWM pond outflow structure will be designed to have bottom draw characteristics. • Landscaping around the ponds will encourage shading.	Detailed Design Detailed Design
On-site drainage paths will be altered with the proposed landfill expansion.	• The proposed expansion areas will be drained by ditches adjacent to the internal roadway system to convey stormwater to the SWP ponds before discharge.	Detailed Design
ARCHAEOLOGY		
Potential for discovery of unknown archaeological resources.	• Should undocumented archaeological resources be uncovered during landfill construction, alteration of the site must cease immediately. • If undocumented archaeological resources are uncovered, a licensed archaeologist should be contacted to carry out archaeological fieldwork in compliance with Section 48(1) of the Ontario Heritage Act.	Construction
RESIDENTS AND BUSINESSES / NUISANCE EFFECTS		
Potential for nuisance noise effects during construction and operations at the landfill that may disrupt residents or businesses.	• The installation of a 2.5 metre high perimeter berm along the south and west sides of the compost pad to shield noise generating activities. • Ongoing engagement and response to public complaints.	Construction Operation
Potential for nuisance odour effects during operations at the landfill that may disrupt residents or businesses.	• Minimizing the size of the active area. • Minimizing the storage time of waste prior to disposal within the active area. • Appropriate management of leachate. • Use of daily cover. • Use of odour neutralizing agent applied to the biosolids. • Use of a portable odour fogging machine to effectively distribute odour neutralizing agent at the site. • Enhanced biosolids trailer washing. • Use of impermeable waterproof tarps on the biosolids trailers. • Construction of a Biosolids Management and Processing facility.	Operation

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
	• Use of fully sealed trailers to transport biosolids in conjunction with the implementation of a Biosolids processing facility. • Staged expansion of the landfill gas collection system. • Ongoing engagement and response to public complaints.	
Potential for additional odour associated with landfill mining.	• Development and ongoing updates as appropriate of an Odour Management Plan (OMP) supplement. • Completion of a pilot landfill mining program to characterize the type of waste and odour profile. Use of the information from this pilot to develop standard operating practices (SOP) for the full scale mining program. • Train all staff on the OMP and SOPs. • Management of landfill mining operations based on meteorological conditions (e.g., shut down during calm periods or specific wind direction). • Daily inspection program used to adjust and refine mining operations. • Bypass screening of waste where highly odorous material is excavated. • Use of chemical and biological treatment to reduce significance of odour. • Use of periphery odour misting system. • Minimize size of active landfill mining excavation. • Cover applied to mined area at the end of the day. • Keeping local residents informed and respond to public complaints. • Develop and implement a monitoring campaign for landfill mining.	Landfill Mining
Potential for off-site dust effects from construction and operation of the proposed expansion can be a source of nuisance.	• Best management practices for dust at the site will include watering of gravel roads when needed. • Main access road and site perimeter road shall be hard surfaced to minimize dust nuisance.	Construction & Operation
Concerns regarding increased numbers of bears.	• A vermin management plan will be developed and detailed in the Design and Operations report.	Design
PLANNED LAND USE		
Sections of the site will need to be re-zoned.	• Re-zone additional property under Special Exemption 23.	Detailed Design
Potential for future development within the expanded area of influence for the site.	• The City will consider the expanded area of influence in deliberating over any proposed land use matters that fall within their control.	Ongoing

TABLE 8.1
TABLE OF COMMITMENTS TO MITIGATION AND MONITORING

Impact Areas and Issues	Proposed Mitigation and Monitoring	Approximate Timing
VISUAL		
Some potential for visual impact; however, anticipated to be minimal given topography and treed location.	• Planting of vegetative buffers on berms where necessary to obscure the feature from the surrounding areas. • Application of native grass/wildflower vegetative cap mixture that will improve the aesthetic quality of the landfill feature itself.	Detailed Design Cell Closure
TRANSPORTATION		
Safety is a concern to area residents and businesses	• Sight-line improvements and a detailed review to confirm the suitability and adequacy of warning signage at the Fifth Line/Hwy. 17 intersection. • Enhancements to the road geometrics should be considered in conjunction with the next capital improvement project along the Highway in this area. • Review of accident history every 5 years to identify high risk road segments or intersections. • Monitor vegetation growth within the right-of-way and maintain maximum sight lines.	Detailed Design When Highway Improvements are Considered Ongoing During Operation
Traffic is a concern to area residents and businesses.	• Conduct 24 hour traffic counts over a period of several days along Fifth Line to the east and west of the landfill entrance and confirm adequacy of the lane configuration every 5 years. • Conduct 8 hour intersection traffic count at the Fifth Line/Hwy 17N intersection to confirm adequacy of the level of service, lane configuration and intersection controls as needed based on volume. • Continue to complete road condition assessments and schedule maintenance/repairs/upgrades as required in accordance with the City's Road Management Plan.	Ongoing During Operation

9.0 PUBLIC AND AGENCY CONSULTATION

The Environmental Assessment process is designed to be responsive to comments, issues or concerns that are raised by government agencies, stakeholders, Aboriginal Communities and the general public. A comprehensive public consultation program was devised to solicit input from a broad cross-section of people and interests, ensure issues were identified as early as possible in the process and provide a means for addressing and incorporating input received. The principle goals of the consultation process include:

- Enhance the quality of the decision making process by capturing ideas and experiences of a broad cross-section of people;
- Ensure transparency in the decision making process;
- Enhance public understanding of the process, and rationale for the decisions reached; and
- Meet legislative requirements.

The following summarizes the consultation activities undertaken and input received. The full consultation report is included as **Appendix O**.

9.1 Notification and Newsletters

Notices and newsletters were used to initiate the project and provide updates and invite participation in consultation events.

Advertisements and notices were placed in the local newspapers (Sault Star and Sault This Week), mailed or emailed to all individuals on the project mailing list, posted on the City website and when available included on the community calendar on Shaw Cable 10. Notices and advertisements were also distributed to adjacent communities for posting on community bulletin boards and websites and/or publishing in their newsletters.

Five newsletters were prepared to provide people with information about the project and invite them to events.

9.2 Web Page

A webpage has been established on the City of Sault Ste. Marie website. This page includes important and relevant planning documentation that was developed prior to initiating the EA together with documentation that has been developed within the framework of the EA process. The site also provides contact information for the Consultant Project Manager and the City's principle contact. The webpage has been updated periodically and updates will continue to be made as the study continues to progress.

Invitations were also extended to neighbouring communities, including Aboriginal Communities, to explore the possibility of including a link to the City's webpage on their community websites with the ultimate goal of enhancing the level of engagement.

9.3 Elected Official and Agencies

In addition to the consultation activities described elsewhere in this document, focused activities were undertaken to engage Elected Officials and review agencies that may have an interest in the project. Elected Officials at the Municipal level and numerous review agencies were included on the project mailing list and were kept apprised of the project progress as the study evolved. The Agencies generally provided guidance regarding process requirements and the respective mandates of their Agency. Details of the input provided by Agency representatives are included in the Public Consultation Report included in **Appendix O**.

9.4 Public Input Sessions

Public open houses and workshops were undertaken to disseminate project information and solicit input at key milestones or decision points within the process. The events were staged to solicit feedback and input from government agencies, stakeholders, Aboriginal Communities and the general public.

The format for the "workshops" included a presentation followed by the formation of focus groups to provide input specifically tailored to the topics and issues being contemplated at the time (eg. evaluation criteria, evaluation methodology, etc.). The workshops were led by consultant staff with the assistance of Municipal staff. The input was solicited through the completion of "workbooks" by focus groups.

The "open houses" were intended to be less formal and consisted of a series of display panels arranged to guide individuals through the process. The project consultants, with the assistance of City staff ushered individuals or groups of individuals through the presentation materials, explained the contents and addressed questions and issues.

Both formats were used to cater to the preferences of individuals. Some individuals prefer a more formal setting while others are more comfortable with a less formal setting and one on one time with consultant or City staff.

The principle objectives of the workshops and open houses were:

- communicate project progress;
- solicit input and feedback;
- enhance the quality of the decision making process by making adjustments as necessary based on the feedback received; and
- enhance understanding of the process and the decisions reached.

A summary report was prepared at the conclusion of each event which documents the issues, questions and concerns raised together with the responses provided.

Five (5) public input sessions where held:

- Public Input Session #1 on “Alternatives To” (June 26, 2007);
- Public Input Session #2 on Preferred “Alternative To” and Next Steps (June 3, 2010);
- Public Input Session #3-Evaluation Approach/Criteria for a new Site vs. Expansion of an Existing Site and Preliminary preference (April 19, 2011);
- Public Input Session #4 - Evaluation Approach/Criteria and Preliminary Preferred Expansion Option (March 6, 2012); and
- Public Input Session #5 – Impact Assessment for the Preferred Option (February 9, 2016).

The following provides information on the input received at these sessions.

9.4.1 Public Input Session #1 on “Alternatives To” (June 26, 2007)

A public input session was conducted on Tuesday June 26, 2007 in the Russ Ramsay Boardroom of the Sault Ste. Marie Civic Centre. The session provided a forum for interested individuals, Aboriginal representatives, agency representatives, and property owners, to discuss the “alternatives to” the undertaking and criteria used to compare and select a preferred approach to dispose of waste in Sault Ste. Marie, Prince Township and Batchewana First Nation’s Rankin Reserve. The meeting format included a presentation followed by facilitated discussions regarding the alternatives and the evaluation criteria.

Table 9.1 highlights comments/questions raised and responses provided during the presentation portion of the meeting.

Table 9.1
QUESTIONS AND RESPONSES REGARDING THE "ALTERNATIVES TO" – JUNE 2007

Questions	Response
Where would the hazardous waste from an incinerator go?	It would need to be taken to a hazardous waste facility near Sarnia or other suitably licensed site.
How big a landfill would be needed?	Based on the projections, a landfill that could accommodate approximately 2.3 million tonnes would be needed. A typical landfill footprint for a 2.0 million tonne landfill would likely be in the range of 20 Ha.
Have you considered population in your waste quantity disposal projections?	Yes, the waste quantity projections are based on population projections done by another consultant. The total estimated Sault Ste. Marie population in 2046 is nearly 86,000 (Note: the City Planning department revised their projections in 2015. As a result of those revisions the projected 2046 was reduced to 82,820).
Have you considered increasing the service area so that incineration or high heat technologies would be more cost effective? Sault Ste. Marie could service a larger area as a profitable business generating jobs for our residents. You should establish a committee with a mandate to look at this.	A waste management steering committee comprised of City staff is overseeing the project. The City's mandate is to look after its own waste and that is the intention of this study. The province has also recently released a draft provincial policy statement which encourages the management of waste close to source. The transport of waste over significant distances results in additional impacts including noise, dust and air emissions. The private sector is more likely to explore opportunities for a facility servicing a broad geographic region.
Can there be more than one "Alternative to" selected?	Yes, the preferred waste system is likely to include a combination of the alternatives. For example, it is expected that increased 3R's would be part of the system along with one or more disposal method(s).
Doesn't diversion have a bigger service area?	The collection of blue and yellow box materials outside of the study area is a private collection and is not part of the municipal system.
Would a high heat process be able to manage nuclear or hospital waste?	Requires further study and would be looked at if "high heat" is the preferred "Alternative To".
It was suggested that the City 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.	Agreed.
It was noted that the timing of the meeting right before a long weekend made it challenging to attend as this is a very busy week.	It was noted that the project team wanted to have a meeting prior to vacation season. Future sessions will consider statutory holidays.

In addition to the foregoing feedback obtained through the facilitated discussions three completed workbooks were also received following the consultation event.

In general, preferences were noted for waste diversion, incineration/high heat processes and landfilling. Export and do-nothing were identified as impractical and unrealistic. Comments that were included in the workbooks together with responses are summarized in the **Table 9.2** below.

Table 9.2
SUMMARY OF COMPLETED WORKBOOKS

Comment	Response
The selected system should allow conversion of waste into energy without sorting.	Some sorting is completed at source as part of the recycling programs including the public drop-off area at the landfill site. Typically no additional sorting is done for landfilling however most incineration/high heat processes will include some upfront sorting.
Consider processing of waste for the Region as a potential job creation strategy.	See response in Table 9.1.
Consider impacts of combined alternatives.	Consideration of combined impacts is included in the rankings under each criterion.
Quality of residues from incineration and high heat processes is dependant on what is included in the waste which is difficult to control.	Agreed.
Concerns were noted with possible need for land expropriation and the location of the existing site on the City's aquifer.	Property impacts are considered at a general level at this time but will be considered in greater detail in the next phase of the process. Potential impacts to surface water resources is included. An engineered leachate collection and management system is included in the landfilling alternative.
It is important that waste reduction is included as an alternative or at least incorporated as part of the waste diversion alternative.	The waste diversion alternative includes the 3 R's (reduce, reuse, recycle).
Concern was noted that incineration and high heat processes may generate more hazardous waste than is noted in the EA documentation.	The information included in the documentation was obtained through research completed on existing operating facilities.
Skepticism was noted that incineration/high heat processes are safe. Research needs to be independent and unbiased.	Incineration and high heat processing plants would be required to meet MOECC regulated emission requirements of the day. Facilities must be instrumented with monitoring equipment to demonstrate on going compliance.
Need to consider leachate impacts and impacts on habitat associated with landfilling including attraction of bears and rats.	This is considered at a general level at this time and will be considered in more detail in the next phases of the process.

9.4.2 Public Input Session #2 on Preferred "Alternative To" and Next Steps (June 3, 2010)

A public information centre was conducted on Thursday June 3, 2010 in the Thompson Room at the Civic Centre. The session provided a forum for interested individuals, agency representatives, Aboriginals 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" the undertaking evaluation, identify next steps in the process and have questions answered. The session was conducted in an open house format which allowed interested individuals to attend at any time between 3:30 pm and 7:30 pm.

Representatives of the Consultant team and the City of Sault Ste. Marie were in attendance throughout the session to provide information, address questions, and facilitate discussions. A total of 10 individuals recorded their names on the sign-in sheet. Some individuals in attendance did not record their names on the sign-in sheet.

During the conduct of the Open House, no comment sheets were received. There were however, a number of comments/questions that are summarized in **Table 9.3**.

Table 9.3
COMMENTS/QUESTIONS FROM THE JUNE 2010 INFORMATION SESSION

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 versus thermally processing these plastics is beyond the scope of this study and should be done at the Provincial level as part of the material designation process.
A concern was noted with 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 west of the landfill to address water quality concerns in drinking water wells.	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 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 and any comments on individual rankings are encouraged.

9.4.3 Public Input Session #3 Evaluation Approach/ Criteria for a new Site vs. Expansion of an Existing Site and Preliminary Preference (April 19, 2011)

A public input session was conducted on Tuesday April 19, 2011 in the Russ Ramsay Room at the Civic Centre. The session provided a forum for interested individuals, agency representatives, Aboriginals and stakeholders, to obtain updated information regarding waste management planning, gain an understanding of the Environmental Assessment process, review and provide comments on the criteria and approach used to evaluate a new site versus expansion of an existing site, discuss and comment on the preliminary results of the evaluation, provide input regarding the evaluation criteria to be used in the next steps and have questions answered. The session included a presentation by the consultant team followed by a question and answer period and a working group session to complete the workbook.

Representatives of the Consultant team and the City of Sault Ste. Marie were in attendance throughout the session to disseminate information, address questions, and facilitate discussions.

Questions/comments raised during the presentation are summarized in **Table 9.4**.

Table 9.4
COMMENTS/QUESTIONS FROM THE APRIL 2011 INFORMATION SESSION

Comment/Question	Response
Is 34% diversion comparable to other municipalities	Yes. City of Sault Ste. Marie is in line with other similarly sized municipalities with similar diversion programs.
In southern Ontario there is a large weight associated with newspapers so their diversion rate shows as higher. We should use volume to indicate diversion rate rather than weight.	It is very difficult to measure volume and weights are much more practical/convenient.
Sudbury diversion rates are higher but they do collect more plastics and they have organics collection. It is a single stream process with improved participation. The waste from the Sudbury MRF is approximately 1.5-4%	No response required.
Are there items banned from the landfill?	Yes old corrugated cardboard and leaf and yard waste are banned.
Elementa tried to do their EA and Certificate of Approval at the same time. They should have finished one process and then gone to the next.	No response required.
How much of the residual waste is organics?	Based on previous studies completed, approximately 30-40% of the waste stream is organic.
How much does the existing site cost? How much less will an expansion cost compared to a new site?	Although detailed estimates have not been completed qualitatively an expansion is less costly and the rationale is detailed in the EA report.
The City has improved odour control with the installation of the gas management system. Sludge is the remaining issue that needs to be dealt with at the existing site.	Agreed. A biosolids management plan has been completed to mitigate odours in transit to the landfill and at the site itself. The City is initiating implementation in 2016.
Needs to be clear that, while local residents may have become used to the site it does not mean that they like it.	Understood. The City will continue to be as proactive as possible to continually improve nuisance management at the site.
Representatives from Elementa indicated that they can process any carbon based material that is available. In their discussions with Spain they understand that landfills are banned there. The comment “why bury energy” was made.	The City has endorsed a waste supply agreement with Elementa which provides for the management of a portion of the residual waste stream in an energy-from-waste facility.
Is the City of Sault Ste. Marie looking at new recycling products? The City should work with the contractor to get more recyclable materials collected.	The City’s contract for recycling collection and processing includes provisions to consider new products. The inclusion of new material is however contingent upon having an established market to purchase/utilize the materials.

Following the presentation and question/answer period, a small group discussion was held with participants to go through the public input session workbook. Six participants joined in the small group discussion including two site neighbours. Participants were asked to comment on the project team's preliminary conclusion that a landfill expansion is preferred over the development of a new site and the key differences between the two options. Participants commented as follows:

Table 9.5
COMMENTS/QUESTIONS DURING WORKING GROUP SESSION

Comment/Question	Response
An expansion option assumes there is land to expand into. We need to confirm that there is enough room.	This is an important consideration and will be addressed in Step 2 of the Alternative Methods evaluation provided expansion is selected as preferred in Step 1.
Should consider mining the existing site and expanding upwards. You could remove recyclables from the mined material and then take it to Elementa for processing.	Mining and a vertical expansion will be considered in the next step of the Alternative Methods phase. Recoverable materials encountered during the mining operations would be separated and marketed.
It was noted that you could always mine the existing site even if a new site was identified as preferred.	Agreed, however there would be two sites that would generate nuisance impacts and would require additional resources to operate and manage.
A new site brings a lot of headaches – Where are you going to find a clay dish like you have at the existing site? You will spend 10 years and a lot of money to look for a new site and then find out at the last minute that there is something about it that makes it not workable.	The search for a suitable new site can be very time consuming and costly and typically generates significant anxiety in communities. Significant investment can occur with no guarantees that a workable site will be established. This is also the case for site expansion but a lessor investment is likely required. Both a site expansion and a new site will however require a liner to manage leachate.
The existing site is a known quantity.	Agreed. This was cited as an advantage in the evaluation.
We don't have the density and sprawl in Sault Ste. Marie that they have in southern Ontario so we could probably find a new site that might be better than the existing site.	The search for a suitable new site can be very time consuming and costly and typically generates significant anxiety in communities. Although a new site could potentially be identified the preliminary conclusion reached through the evaluation completed is that the City should initially focus resources on assessing the practicality and net impacts of an expansion. A search for a new site was also completed in the late 80's with limited success.
You will run in to NIMBY if you try to site a new landfill. Residents and property owners were concerned with wind turbines so they are certainly going to be concerned with a landfill.	Agreed.

Table 9.5
COMMENTS/QUESTIONS DURING WORKING GROUP SESSION

Comment/Question	Response
It was noted that both sites have similar potential for disruption to the neighbouring community.	Agreed but there has been some adaptation with the existing site.
Concern about mining is the odour. There was a lot of odour when they dug into the site to place the pipes for the landfill gas collection system.	Odour is a significant concern associated with mining operations and will require close attention to best practices to mitigate. The intent would also be to limit the timeline for mining operations.
Don't think a community will allow a new landfill. The City should go with what we have and make it better.	The preliminary conclusions reached through the evaluation suggest focusing on an expansion for a number of reasons as noted elsewhere in the report. The intent would be to further improve the environmental management features at the existing site in conjunction with an expansion.
It was suggested that an expansion could not go east or south, there is not much room to go west, and the north is the best direction for an expansion as there are no additional people to impact. North was preferred over going higher. A separate fill area to the north was suggested.	Various expansion options will be explored in the next step of the process if the preferred alternative from the current step is expansion. It was acknowledged that expansion east or south is not likely practical.
It was acknowledged that there would be a cost savings with an expansion over a new site.	Agreed.
There was discussion on the lifecycle cost of existing equipment and whether it could be re-used if a new site was selected. It was suggested that the equipment cost difference for the site is probably not that great and should not be what is relied upon to make the decision between the options.	It was noted that in addition to the equipment there are infrastructure items on the current site that could potentially be reused including site roads, weigh scale(s), scale house and administrative and maintenance buildings existing groundwater, surface water and landfill gas monitoring systems. Collectively these items could result in a substantial cost savings.
It was noted that investigations on a new site would be very costly and there is a lot less certainty than with an existing site.	The search for a suitable new site can be very time consuming and costly and typically generates significant anxiety in communities. Significant investment can occur with no guarantees that a workable site will be established. Although a significant investment is also required for a site expansion the required investment is likely much less given the significant knowledge that pre-exists for the site.
Don't think that a new site would be much harder to approve but it would be harder to get buy-in from the community.	Agreed that there may be increased challenges in obtaining buy-in from the community for a new site particularly if it is located near sensitive uses. The approval for a new site would require more extensive investigations to ascertain potential impacts particularly with groundwater.
The existing site is well run there have been improvements (e.g. gas management). The sludge	A biosolids management study has been completed to address the management, nuisance

Table 9.5
COMMENTS/QUESTIONS DURING WORKING GROUP SESSION

Comment/Question	Response
smell and potential for groundwater impacts are the only issues at the existing site that neighbours are concerned about. If you fix these issues then there is no problem with the existing site.	impacts and potential beneficial use of the sewage biosolids. The City plans to initiate implementation in 2016. The City has been effectively monitoring and managing groundwater quality at the existing site and expansion would include further enhancements to the existing leachate management features and protocols.
One option to fix the concern about groundwater is to supply municipal water to local residents.	Consideration will be given to potential impacts to private well supplies in the next phase of the study.
The long term plan for the landfill is good but we should also be focusing on what we can do to help Elementa. It was noted that their biggest issue at this point was getting an appropriate electricity rate from the Ontario Power Authority. Waste-to-energy is the only thing not included in the government's feed-in-tariff program and it should be.	The City has endorsed a waste supply agreement with Elementa. It is anticipated that Elementa will continue to negotiate with OPA with the goal of establishing an acceptable power purchase agreement.
It was noted that we should be focusing on reducing and recycling.	Increased 3R's was identified as an important element of the overall preferred solution identified in the first phase of the study and the City is committed to investigating and implementing cost effective 3R's strategies.

There was not sufficient time to review the evaluation criteria to be used in the next step. Participants suggested that they liked the approach taken to date where the team goes through the evaluation using their technical expertise and brings it back to the community for review and input.

In addition to the workbook that was collectively reviewed by the group at the Public Input Session, a member of the public also submitted a completed workbook. Comments were made throughout the workbook and were summarized as follows:

"I agree with the preliminary conclusions….however the City must continue to find ways to reduce the amount of garbage in the first place."

9.4.4 Public Input Session #4 - Evaluation Approach/ Criteria and Preliminary Preferred Expansion Option (March 6, 2012)

A Public Input Session was conducted on March 6, 2012 in the Russ Ramsay Room of the Civic Center. Representatives of the Consultant team and the City of Sault Ste. Marie were in attendance throughout the session to provide information, address questions, and facilitate discussions. The information session was open from 3:30 p.m. to 7:30 p.m. with a total of seventeen (17) individuals recording their names on the sign-in sheet.

The principle objective of the Step 2 Alternative Methods consultation task was to obtain feedback from the general public, agencies, Aboriginal Communities and stakeholders regarding the evaluation criteria and the preliminary results. To assist in soliciting as much input as possible, a questionnaire was developed to provide targeted feedback and a comment sheet was made available to provide general comments. The questionnaire and comment sheet were available at the March 6, 2012 Public Input Session and were posted on the project webpage on the City's website. In addition digital responses were encouraged through Survey Monkey, an online survey website. The information received through the various formats is summarized in the **Table 9.6**.

Table 9.6
SUMMARY OF COMMENTS/INPUT RECEIVED AT THE MARCH 2012 PUBLIC INPUT SESSION AND THE PROJECT TEAM'S RESPONSES

Comments	Response
Suggested that a waste-to-energy vendor be invited to convert our waste (Elementa or an alternate vendor).	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 has plans to construct a new larger-scale facility, with an estimated annual throughput capacity of at least 35,000 tonnes. In 2009, the City 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. The project implementation has been delayed on a number of occasions and the waste supply agreement was amended on a number of occasions to reflect changes in waste supply commencement dates. Furthermore Elementa was ordered into receivership in December 2015 and the future of the waste supply contract is unknown. The most recent amendment to the contract included a latest construction start date in May 2016 but this was not achieved.
Prevent leachate from entering groundwater and surface water sources.	The proposed expansion includes strategies to mitigate potential adverse impacts to ground and surface water that could be generated from the proposed expansion area. The preliminary preferred expansion option also includes provisions to enhance ground and surface water protection measures associated with the existing disposal footprint. Further details will be forthcoming in the next phase of the project (ie. detailed impact assessment)
The necessity and cost of the proposed landfill mining in the western portion of the existing	Although landfill mining is not a "necessity" there are pros and cons to this component of the

Table 9.6
SUMMARY OF COMMENTS/INPUT RECEIVED AT THE MARCH 2012 PUBLIC INPUT SESSION AND THE PROJECT TEAM'S RESPONSES

Comments	Response
footprint was questioned.	preliminary preferred option. Landfill mining provides an opportunity to enhance groundwater protection measures associated with the existing disposal footprint. A secondary benefit is the additional disposal capacity sourced by separating the waste from the fines and re-landfilling only the waste. The principle drawbacks to landfill mining are the added cost, nuisance impacts (ie. odours, dust, noise) and worker protection. The feedback that we have received to date is that the long term ground water quality benefits outweigh the added costs and short term operational impacts.
Displays and presentation was well done and very informative.	No response required.
Consideration should be given to petition the expansion of the current Provincial Groundwater Monitoring Network (PGMN). This expansion could allow for additional groundwater quality and quantity monitoring away from the landfill. The additional monitoring capability would increase the predictability of any potential threat of off-site contamination and allow the operators of the municipal drinking water distribution network to have ample notice of any impending issues. Policies will be included in the Municipality's Source Protection Plan to address.	There is an extensive network of monitoring wells located within and immediately adjacent to the existing waste disposal site. This network provides ample opportunity to assess groundwater quality within and adjacent to the site. We support your suggestion that there are benefits to expanding the PGMN within the capture zones of the municipal wells to identify contaminants well in advance of reaching the well head.
Concern was expressed regarding the long term quality of drinking water sourced from private wells adjacent to the site.	There is an extensive network of monitoring wells located within and immediately adjacent to the existing waste disposal site. This network provides ample opportunity to assess groundwater quality within and adjacent to the site. Despite the extensive monitoring network we understand the concern raised and further consideration will be given to this concern in the next phase of the project (ie. detailed impact assessment).
Concern was expressed with the location of a landfill on a significant ground water recharge area but also acknowledged that the expansion of the existing site allows an opportunity to help reduce the risk of the existing landfill operation with ongoing monitoring and through the application of partial or total impervious cover over the existing footprint to limit infiltration and leachate production.	Although the location of the existing waste disposal site may not be ideal the ongoing operation and site monitoring by the Municipality has demonstrated that leachate is being effectively managed as demonstrated through the annual reporting. Despite the effective leachate management the City believes the proposed expansion offers an opportunity to further enhance the protection measures associated with the existing disposal site. These measures may include a liner at the base of

Table 9.6
SUMMARY OF COMMENTS/INPUT RECEIVED AT THE MARCH 2012 PUBLIC INPUT SESSION AND THE PROJECT TEAM'S RESPONSES

Comments	Response
	the waste and at the interface between the new and existing waste in the expansion areas, a partial or full impervious final cover design, mining and lining a portion of the existing site and installation of a horizontal collector along the western boundary of the expansion area.
Support for landfill mining to improve ground water quality but also identified a need to consider air quality and protection of workers during the operations.	There are pros and cons to landfill mining. Landfill mining provides an opportunity to enhance groundwater protection measures associated with the existing disposal footprint. A secondary benefit is the additional disposal capacity sourced by separating the waste from the fines and re-landfilling the waste only. The principle drawbacks to landfill mining are the added cost, nuisance impacts (ie. odours, dust, noise) and worker protection during the operations. Further consideration of the nuisance impacts and safety will be included in the detailed impact assessment.
Composting should be fast tracked by the MOECC.	The City, through its Consultant, interacted regularly with MOECC staff regarding proposed changes to the composting regulations. Ultimately new regulations were released by the MOECC in July, 2012 which provide enhanced flexibility in composting biosolids.
Support expressed for Option 3 - North and West Expansion B. Also suggested that landfill mining should be considered as technology becomes available and this option becomes more cost competitive. It was also noted that there should continue to be a focus on recycling.	Although there is additional expense associated with the proposed landfill mining it will help to mitigate potential ground water impacts to the south west of the site. The preferred solution that was identified in the "Alternatives To" stage of the process included increased waste diversion and the City is committed to investigating and implementing cost effective ways and means of reducing residual waste disposal quantities.
Every effort should be made to reduce the timeframe to initiate the landfill expansion plan.	The City is committed to moving forward with the next steps of the EA process and the technical approvals required for the expansion.

9.4.5 Public Input Session #5 – Impact Assessment for the Preferred Option (February 9, 2016)

A Public Input Session was conducted on February 9, 2016 in the Russ Ramsay Room of the Civic Center. Representatives of the Consultant team, and the City of Sault Ste. Marie were in attendance throughout the session to provide information, address questions, and facilitate discussions. The information session was open from 3:30 p.m.

to 7:30 p.m. with a total of nine (9) individuals recording their names on the sign-in sheet.

The principle objective of the Impact Assessment consultation task was to obtain feedback from the general public, agencies, Aboriginal Communities and stakeholders regarding the identified impacts and the proposed mitigation measures for the preferred option. A comment sheet was provided which incorporated two key questions and provided space to record any other comments or concerns. The comment sheet was also posted on the project webpage on the City's website. The information received through the various formats is summarized in the **Table 9.7**.

Table 9.7
SUMMARY OF COMMENTS/INPUT RECEIVED AT THE FEBRUARY 2016 PUBLIC INFORMATION SESSION AND THE PROJECT TEAM'S RESPONSES

Comments	Response
Concern was expressed with litter sprawl and plastic bags and odours.	The City has proactive litter pickup protocols in place at the landfill site which include manual and mechanical collection methods. There are a significant number of odour mitigation protocols in place as follows: • In 2010 the City completed an upgrade from a "passive" system to an "active" landfill gas collection system over a portion of the site. The system reduces the quantity of methane released to the atmosphere (ie: reduces the carbon footprint of the site) and also reduces odours generated at the site. • In addition to landfill gas, biosolids (i.e: sewage sludge) delivered to the site for disposal may also contribute to off-site odours. The City continues to be proactive in its efforts to manage and mitigate odours associated with the transport, management and disposal of biosolids. • An odour neutralizing agent is applied to the biosolids at the water pollution control plants prior to delivery to the landfill site. Once the biosolids are tipped at the working face they are mixed with other wastes and cover is applied promptly. A hand held sprayer is used by the vehicle operators to apply an odour neutralizing agent to the empty trailers before they leave the site throughout the year. • Early in 2013, mesh tarps were replaced with impermeable, waterproof tarps on one biosolids trailer at the west plant and two biosolids trailers at the east plant to mitigate odour release in transit to the landfill. • Regular trailer washing was also initiated in 2013 to remove residual biosolids from the outside faces and wheels of the trailers. • A Biosolids Management Plan has been completed and the City is insisting the implementation of the recommendations which includes a new processing facility and improved transportation to the site.

Table 9.7
SUMMARY OF COMMENTS/INPUT RECEIVED AT THE FEBRUARY 2016 PUBLIC INFORMATION SESSION AND THE PROJECT TEAM'S RESPONSES

Comments	Response
	Careful attention will also be given to the implementation of best management practices to mitigate odours associated with the proposed landfill mining operations. Local residents are encouraged to contact the landfill to alert operations staff of any issues related to litter sprawl or odours to ensure actions are taken to mitigate nuisances.
A request was made to undertake groundwater sampling to the north of the landfill to confirm impacts are not migrating to the north.	There are several monitors that are located to the north of the disposal footprint that have been sampled historically and have been used as background monitors because they have not shown any significant impacts. In addition there is a significant inventory of groundwater monitors that have consistently demonstrated that groundwater flows south, south-east and south-west from the landfill site.
A representative of Ellwood Robinson Ltd. (local Contractor) requested that access be maintained to their pit in conjunction with the proposed expansion. The pit is currently only accessible through the landfill site.	City staff noted that they believe there is an agreement addressing access to the pit and it will continue to be respected in conjunction with the proposed expansion.
A local resident had several questions related to pay-as-you-throw programs, source separated organics/ backyard composters, bi-weekly waste collection and the use of clear bags for waste disposal.	A detailed response was issued and it describes the current partial pay-as-you-throw program and future potential enhancements, the challenges with a source separated organics collection and processing program and bi-weekly waste collection in Sault Ste. Marie, the potential for future enhanced public education related to backyard composting and considerations in mandating clear waste disposal bags in the future. In addition we provided a comprehensive summary of 3R's initiatives that are integral to the City's waste management plan.
A local resident questioned what initiatives are planned to enhance diversion and the status of the proposed waste-to-energy facility.	We provided a comprehensive summary of current and proposed future 3R's initiatives that are integral to the City's waste management plan. We also explained that the waste-to-energy project has been delayed on several occasions and the contract with the City has been amended at the request of the vendor. The current contract identifies the latest possible construction start in May 2016 which was not achieved. In addition in December 2015 the vendor was ordered into receivership and the future of the contract with the City is unknown.

9.5 Consultation with First Nations

In addition to the formal public consultation events which were intended for residents, agencies and Aboriginal Communities, additional activities were specifically undertaken

to engage various Aboriginal Communities that may have an interest in the project. The Aboriginal Communities and Agencies that were consulted consisted of the following:

- Batchewana First Nation;
- Garden River First Nation;
- Historic Sault Ste. Marie Metis Council;
- Metis Nation of Ontario Historic Sault Ste. Marie Traditional Territory Consultation Committee;
- Missanabie Cree;
- Anishinabek/Union of Ontario Indians;
- Association of Iroquois and Allied Indians;
- Ministry of Aboriginal Affairs; and
- Indigenous and Northern Affairs Canada.

The agencies contacted provided guidance with respect to the Aboriginal consultation process and the relevant Aboriginal Communities to be contacted. The approach taken in developing the Aboriginal Community contact list included a review of Aboriginal Communities that are proximal to the project. This was completed by reviewing available online mapping together with a review of land claims in the area (Note: none were identified that would impact this project). Consideration was also given to the Aboriginal Communities that were contacted on other similar City of Sault Ste. Marie infrastructure projects.

The steps taken to solicit input from Aboriginal Communities are summarized below and complete details are included in the consultation report included in **Appendix O**.

Throughout the project regular contact was maintained with Aboriginal Communities. The following summarizes the key methods of exchanging information that occurred during the project:

- ***Project Introduction and Consultation Strategy*** - Letters were mailed in January, 2007 to Aboriginal Communities (ie. Batchewana First Nations, Garden River First Nations, Missanabie Cree First Nation and the Métis Nation of Ontario) requesting to meet to discuss the EA and consultation strategies. Meetings were held in March 2007 with Batchewana First Nation, Garden River First Nation, the Missanabie Cree First Nation, and the Métis Nation of Ontario. Additional meetings were also held with Garden River First Nation and Batchewana regarding consultation strategy.

- ***Public Input Session Notification*** – First Nation Community members were invited to all public input sessions. Hardcopy and digital notices were distributed to all First Nation communities. Requests were made to post notices in prominent locations in their communities.

- ***Aboriginal Public Input Sessions*** – Offers were extended to conduct dedicated sessions in Aboriginal Communities at key points during the study process. A Public Input Session was held on August 9, 2007 in Garden River First Nation to

obtain input on the alternatives being considered and the evaluation criteria as presented in the "Alternatives To" Working Draft. An offer was made to hold a similar sessions in other Aboriginal Communities.

- ***Progress Updates*** – The project team issued project updates to Aboriginal Communities on an ongoing basis and also attended Band Council and Committee meetings.

9.6 Historical Consultation Activities

A significant level of consultation occurred through the Waste Management Planning activities undertaken by the City from 2000 to 2005 prior to initiating the EA Planning process. Activities undertaken in the past included:

- **Current Waste Management System Summary Report (September, 2000)** - Inventoried and summarized current (i.e. 1999) waste management programs including costs and revenues.
- **Alternative Waste Diversion/Collection Systems Report (June, 2001)** - Identified alternative waste diversion programs and the quantities that could potentially be diverted.
- **Business and Implementation Plan (February, 2003)** - Identified costs of the existing and proposed waste management programs and explored strategies to recover those costs (bag limits, bag fees, increased tipping and gate fees).
- **Public Open House (September 26, 2001)** - held from 3:00 p.m. to 7:00 p.m. to present information to the public on the alternative waste diversion systems developed for the City of Sault Ste. Marie. In total, 23 people signed into the meeting and 16 questionnaires were received.
- **Public Open Houses (March 18 and 19, 2003)** - held at the John Rhodes Community Centre and Korah Collegiate to present information to the public on the Solid Waste Management Plan and, in particular, the alternative user pay options being considered. In total, 29 people signed into the meetings and 29 questionnaires were received.
- **Public Open Houses (July 3 and 13, 2004)** - conducted to discuss and review the DRAFT terms of Reference document for the Waste Management EA.

10.0 OTHER APPROVALS

Table 10.1 lists other potential approvals that may be required to expand the landfill and the EA documentation that could support these approval processes.

Table 10.1
OTHER APPROVALS

Approval (Acts, Regulations)	Supporting EA Document
Environmental Protection Act	Design & Operations report (Appendix C) Surface Water report (Appendix F) Hydrogeology report (Appendix E)
Ontario Water Resources Act	Design & Operations report (Appendix C) Surface Water report (Appendix F) Hydrogeology report (Appendix E)
Sault Ste. Marie Conservation Authority Permit	Design and Operations Report (Appendix C) Surface Water report (Appendix F)
City of Sault Ste. Marie Zoning Amendment	Land Use report (Appendix J)