FEASIBILITY STUDY
FOR DEVELOPMENT OF A
LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Submitted to:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Project Description

AMEC Earth and Environmental, a division of AMEC Americas Ltd. (AMEC), was retained by the City of Temiskaming Shores (the City) to complete a Feasibility Study to assess alternatives for long-term solid waste management (i.e., landfill disposal). The City has two existing landfill sites, the New Liskeard Landfill and the Haileybury Landfill. The New Liskeard Landfill is currently at capacity and landfill activities have ceased as of June 2009. The Haileybury Landfill is currently in operation, but is anticipated to reach capacity in 2016; under the current waste generation rates. The City initiated the process to identify the most feasible option for establishing new capacity for long-term solid waste disposal. AMEC was retained to assess the feasibility of providing new solid waste disposal capacity by means of a) expansion of one or both of the existing municipal landfill sites; b) the development of a new site; or c) a combination of both strategies.

Once a preferred waste management strategy (i.e., expansion of an existing landfill and/or establishment of a new landfill) is determined to be feasible, the development of this amount of landfill capacity will require a full environmental assessment (EA) under Part II of the Ontario Environmental Assessment Act. This Feasibility Study report does not replace such an EA. Instead, it aims at identifying potentially feasible alternatives on the basis of existing information, visual site inspections, and preliminary engineering concepts. It is envisaged that a future EA on this subject would build on the results of the Feasibility Study, consider stakeholder and public input obtained during the process and supplement the information base with field surveys, refined engineering concepts and further consultation.

1.2 Project Basis & Approach

The original scope of work for the preparation of this Feasibility Study was prepared in September of 2009, and has since been revised due to changes in overall scope and client requests. As such, the current scope of work is arranged into the following key tasks:

Task 1: Project Initiation and Information Gathering (Completed)

- Attend kick-off meeting with the City's Technical Advisory Committee (TAC) to identify waste management/landfill requirements, and possible new landfill sites;
- Secure and review background documentation including landfill operating manuals and annual reports; and,
- Prepare meeting minutes for the project kick-off meeting.

Task 2: Preliminary Assessment of the Feasibility of Expansion of an Existing Landfill (Completed)

- Conduct inspections of existing landfill sites by AMEC's project team and meet with City representatives and landfill operators;

- Prepare a draft Landfill Feasibility Study (Conceptual Assessment) report discussing the feasibility of expansion for the New Liskeard and Haileybury Landfills;
- Submit draft report to the City for review and conduct a conference call with the City to discuss comments; and,
- Finalize the report and submit to the City for reference/use.

Task 3: Preliminary Assessment of the Feasibility of Establishing a New Landfill (Completed)

- Perform desktop review of three (3) sites outside the City [within 10 kilometers (km) of City boundaries] in areas chosen by the City and the TAC;
- Perform desktop review of three (3) sites inside the City in areas chosen by the City and the TAC;
- Prepare a draft Landfill Feasibility (Conceptual Assessment) report discussing the feasibility of establishing four new landfill sites, two (2) sites within, and two (2) sites outside the City limits;
- Submit draft report to the City for review and conduct a conference call with the City to discuss comments; and,
- Finalize the report and submit to the City for reference/use.

Task 4: Consultation Meeting with the Technical Advisory Committee (TAC) (Completed)

- Conduct a TAC presentation meeting to outline the findings of Tasks 2 and 3; and,
- TAC to select a preferred alternative for each of the landfill expansion and new landfill site options for technical assessment.

Task 5: Technical Assessment of Preferred Long-Term Landfill Disposal Strategy (Completed)

- Perform technical assessment of the preferred alternative for each of the landfill expansion and new landfill site options;
- Prepare draft Feasibility Study report providing technical information as well as a business case for each preferred alternative, as well as recommending a preferred overall long-term landfill disposal strategy;
- Prepare three (3) copies of draft Feasibility Study incorporating the findings and comments from Task 2 and Task 3;
- Submit draft Feasibility Study to the TAC for review and comment; and,
- Conduct a conference call with the TAC to discuss comments for incorporation in the final report.

Task 6: Final Feasibility Study Submission

- Prepare and conduct final Feasibility Study presentation to Council; and,

- Prepare and submit final Feasibility Study (including executive summary) to the City for reference/use.

In March 2010, AMEC prepared two Landfill Feasibility Study (Conceptual Assessment) reports on behalf of the City. The first report was titled *Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites* (Existing Sites Report) dated 8 March 2010, and reviewed options for expanding the existing New Liskeard Landfill and Haileybury Landfill sites, which are both owned and operated by the City. The completion of the Existing Sites Report represents the fulfillment of the scope of work Tasks 1 and 2. The second report was titled *Landfill Feasibility Study (Conceptual Assessment) Development of a New Landfill Site* (New Sites Report) dated 15 March 2010, and reviewed options for developing a new landfill sites at two properties located within the municipal boundary, one property located outside the municipal boundary but within a 10 kilometer (km) study zone and the expansion of an existing Harley Township Landfill also located outside the municipal boundary but within a 10 km study zone. The completion of the New Sites Report represents the fulfillment of scope of work Tasks 1 and 3.

This report represents the fulfilment of Task 6 – Final Feasibility Study Report.

1.3 Report Objectives

The objectives of this draft report are as follows:

1) present the preferred conceptual design alternatives from the Existing Sites Report and New Sites Report;
2) augment the conceptual design of each preferred alternative to a preliminary design level;
3) perform a technical assessment of the feasibility of these two preliminary design alternatives;
4) select a preferred long-term landfill disposal strategy;
5) outline for the City the next steps required to obtain regulatory approval of the preferred long-term landfill disposal strategy;
6) submit a draft Feasibility Study finding to the City for review and comment by the TAC and council members;
7) submit a Final Feasibility Study report.

In order to achieve the report objectives, AMEC has structured this report as follows:

- Section 1 – Outline project and report specific goals;
- Section 2 – Review and evaluate historic/projected waste generation and determine the City's needs for future disposal capacity during a 30-year planning period;
- Section 3 – Summarize available background information for the New Liskeard Landfill Site including descriptions of adjacent land use, geology and physical site setting, hydrogeological condition, hydrological condition, and remaining site capacity;

- Section 4 – Summarize available background information for the Harley Township Landfill Site including descriptions of adjacent land use, geology and physical site setting, hydrogeological condition, hydrological condition, and remaining site capacity;
- Section 5 – Develop and present preliminary level designs and preliminary capital cost estimates for the New Liskeard and Harley Township Landfill expansions;
- Section 6 – Establish and discuss a feasibility assessment criteria for expansion of these two landfill sites;
- Section 7 – Ranking and evaluation of each landfill expansion preliminary design alternative against the feasibility assessment criteria;
- Section 8 – Selection of the preferred landfill expansion preliminary design alternative (i.e., long-term landfill disposal strategy);
- Section 9 – Outline next steps and preliminary cost ranges regarding the regulatory approval of the preferred long-term solid landfill disposal strategy;
- Section 10 – Summarize the report conclusions;
- Section 11 – Summarize the report recommendations;
- Section 12 – Present report closure statement; and
- Section 13 – Outline report references.

2.0 HISTORY OF SOLID WASTE MANAGEMENT IN THE CITY OF TEMISKAMING SHORES

AMEC's understanding of the history of solid waste management in the City of Temiskaming Shores is based on the 2 September 2009 project kick-off meeting between AMEC and City representatives, as well as a review of the following background documents, provided to AMEC by the City:

- Provisional Certificate of Approval No. A571505 (New Liskeard Landfill Site), dated 9 May 2000, amended 27 April 2005 and 17 April 2007;
- Provisional Certificate of Approval No. A570402 (Haileybury Landfill Site), dated 10 November 1998, amended 27 April 2005;
- *Corporation of the Town of Haileybury, Landfill Site Approval Report, Project No. E9100*8, revised July 1997, prepared by Sutcliffe Engineers & Surveyors (Sutcliffe, July 1997);
- *Municipal Groundwater Study, Central Temiskaming Area,* dated June 2003, prepared by Knight Piesold Consulting (KPC, June 2003);
- *City of Temiskaming Shores, New Liskeard Landfill, Operation and Maintenance Manual*, dated May 2004, prepared by Sutcliffe Rody Quesnel Inc. (SRQ, May 2004);
- *New Liskeard Landfill Site, Annual Monitoring Report 2004,* dated February 2005, prepared by Sutcliffe Rody Quesnel Inc. (SRQ, February 2005);
- *New Liskeard Landfill Site, 2007 Annual Groundwater Monitoring Report,* dated May 2008, prepared by Jagger Hims Limited (JHL, May 2008);
- *Corporation of the City of Temiskaming Shores, Leachate Plume Delineation and Contaminant Attenuation Zone Calculations, Haileybury Landfill Site,* dated May 2008, prepared by Story Environmental Services (SES, May 2008);
- *City of Temiskaming Shores, Application to Amend Provisional Certificate of Approval Waste Disposal Site No. A570402,* dated June 2008, prepared by Story Environmental Services (SES, June 2008);
- *City of Temiskaming Shores, 2008 Annual Monitoring Report, Haileybury Landfill Site,* dated April 2009, prepared by Story Environmental Services (SES, April 2009); and,
- *Draft Solid Waste Management Master Plan*, dated August 2009, prepared by Earth Tech Canada Inc. (Earth Tech, August 2009).

Certificate Approvals No. A571505 and A570404 are provided in Appendices A and B, respectively.

2.1 Solid Waste Management Facilities

The City of Temiskaming Shores is located in north-eastern Ontario, near the Quebec border, at the head of Lake Temiskaming (Earth Tech, August 2009). The City has a current population of approximately 10,600, and was formed in January 2004 through the amalgamation of the former Town of Haileybury, former Town of New Liskeard and the former Township of Dymond into a single tier municipality (Earth Tech, August 2009). The City has

two existing landfill sites: the New Liskeard Landfill (formally the Town of New Liskeard Landfill) and the Haileybury Landfill (formally the Town of Haileybury Landfill). These sites will be henceforth referred to as the New Liskeard Landfill and the Haileybury Landfill, respectively.

The New Liskeard Landfill, located approximately 3 kilometres (km) west of the former Town of New Liskeard off of Rockley Road, has been used for a landfill site since 1916 (Earth Tech, August 2009). The New Liskeard Landfill currently operates under Certificate of Approval (C of A) No. A571505, dated 9 May 2000, as amended, which approves the disposal of domestic, commercial and non-hazardous solid industrial waste in a 2.02 hectare (ha) landfilling area (i.e., waste footprint) within a total property area of 32 ha. C of A No. A571505 is provided in Appendix A.

The Haileybury Landfill, located approximately 9 km southwest of the former Town of Haileybury off of Highway 11 along Dump Road, has been in operation since 1975 (Earth Tech, August 2009). The Haileybury Landfill currently operates under C of A No. A570420, dated 10 November 1998, as amended, which approves the disposal of municipal waste in a 5.8 ha landfilling area within a total property area of 32.4 ha. C of A No. A570402 is provided in Appendix B.

The City also administers a recycling program through the operation of a material resource facility (MRF) through the Cochrane Temiskaming Waste Management Board (Earth Tech, August 2009). The recycling program includes the collection of paper fibres, aluminium and steel cans, container glass, and No. 1 polyethylene terephthalate (PET) plastic which are deposited at eight drop-off depots located throughout the City (Earth Tech, August 2009).

Figure 1 presents the locations of the communities that form the City of Temiskaming Shores, as well as the locations of the relevant existing landfill properties.

2.2 Solid Waste Management Practices

For the purposes of this report, the discussion of City's waste management practices will focus on the provision of three main services: 1) solid waste collection; 2) solid waste disposal; and 3) recycling/waste diversion.

2.2.1 Solid Waste Collection

The collection of solid waste within the City is governed by the various policies, by-laws and programs established by the former Towns of Haileybury, New Liskeard and Dymond prior to the January 2004 amalgamation. These policies focus on the collection of waste materials from residential, industrial, commercial and institutional sources. In general, residential waste is collected on a weekly basis in the summer months and bi-weekly in the winter months for all towns located within the City. Industrial, commercial and institutional solid waste is collected on a weekly basis in the summer months and on a bi-weekly basis in the winter months in the former Towns of Haileybury and Dymond, while waste collection in the former Town of New Liskeard occurs twice weekly (Earth Tech, August 2009). Earth Tech reports that the City's

various residential collection by-laws allow for the collection of solid waste with the exception of the following “non-collective wastes”:

- Manufacture waste, including wire;
- Oil/gasoline soaked absorbent material or any explosive or highly combustible material;
- Broken plaster, lumber or other waste or residue resulting from the construction alteration, repair, demolition or removal of any building or structure;
- Sawdust and/or shavings;
- Organic matter not properly drained or wrapped;
- Liquid waste;
- Bandages, poultices, dressings and other such waste;
- Hay, straw, manure;
- Night soil;
- Carcass of any animal;
- Live animals or birds;
- Furniture;
- Stock or any wholesaler which shall be regarded as manufacturing waste;
- Discarded truck and automobile tires;
- Tree branches or roots exceeding three (3) inches in diameter;
- Ashes (except in Haileybury);
- Old corrugated cardboard (OCC); and,
- Other materials may, from time to time, be designated by the City as non-collectible waste.

The City operates various special waste collection programs, such as the annual Christmas tree, Spring Clean-Up and Bulky programs where residents can deposit “non-collective waste” such as furniture, large diameter branches, white goods (i.e., stoves and furnaces), fencing, mattresses, bed springs and other general household items at the curb side for collection. The City also operates a limited Hazardous Waste Program for the collection of old/used paint, oils, propane tanks and batteries. Additionally, residents and contractors are able to bring solid waste to the City’s landfill sites for disposal (Earth Tech, August 2009).

As reported in the Draft Solid Waste Management Master Plan, the City’s current reliance on the various solid waste collection policies have resulted in inconsistencies between the collection services offered to the various towns with respect to the schedule/frequency of waste collection, bag limits, bag fees, container sizes, bans on various waste materials, composting, bulk item collection and hazardous waste collection/disposal (Earth Tech, August 2009). As such, the provision of a uniform solid waste collection by-law/policy is identified as the first key objective in developing a more efficient solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009).

2.2.2 Solid Waste Disposal

Prior to amalgamation, the New Liskeard Landfill received waste only from the former Town of New Liskeard, while the Haileybury Landfill received waste from the former Town of Haileybury, the former Town of Dymond, the Town of Cobalt, and from residents of Firstbrook and Lorrain

Townships (Earth Tech, August 2009). Upon amalgamation, all waste from the various towns comprising the City of Temiskaming Shores was diverted to the New Liskeard Landfill. As such, the New Liskeard Landfill reached its approved landfill capacity in June 2009, and is currently no longer accepting waste. Currently, The Haileybury Landfill accepts landfill waste from the entire City, as well as the Town of Cobalt. It should be noted that based on waste generation projections, as discussed in Section 2.4, the Haileybury Landfill is expected to reach its approved landfill capacity by mid-2016. As such, the provision of additional landfill capacity to facilitate long-term waste disposal is identified as the second key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009).

2.2.3 Recycling/Waste Diversion

As stated in Section 2.1, the City operates an MRF facility for the collection of recyclable materials. Earth Tech reports that the current MRF facility does not have the capacity to accommodate the additional volume of recyclable materials resulting from amalgamation and the location of the MRF limits the possibility of expansion (Earth Tech, August 2009). As such, the City's ability to divert recyclable materials from the waste stream is restricted. Additionally, the City currently is in contract with Phippen Waste Management (Phippen) to manage and operate the Haileybury Landfill (Earth Tech, August 2009). It should be noted that Phippen was also in contract to manage and operate the now closed New Liskeard Landfill. Phippen continues to separate bulk items such as white goods (i.e., disposed appliances), waste tires, glass, inert construction fill and reclaimed asphalt, from the landfilled solid waste at the open Haileybury Landfill. These bulk items are generally stockpiled on-Site for removal on a sporadic, as needed basis. As such, the provision of additional capacity for long-term recycling and waste diversion is identified as the third key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009).

2.3 Historical Quantity of Disposed Solid Waste

There are currently no weigh scales at either the New Liskeard or Haileybury Landfill sites, therefore the amount of waste disposed per year at each site is based on the following:

- visual pre-disposal waste volume estimates recorded by Phippen, as provided to AMEC by the City; and,
- quantities reported in the background documents listed in Section 2.0.

Table 1 presents a detailed accounting of the annual quantity of waste disposed of at the Haileybury Landfill from 1997 to 2008, based on pre-disposal waste volume estimates provided to AMEC by the City. A similar detailed accounting for the waste disposed at the New Liskeard Landfill was not provided to AMEC.

A summary of the annual quantity of waste disposed of at the New Liskeard Landfill from 2000 through 2006 is reported in the Section 5.1.1. of the Draft Solid Waste Management Master Plan, and is presented on Table 2. The quantity of waste disposed in 2009 is currently not

known, although the amount of waste disposed in 2008 was provided by the City as approximately 25,447 cubic yards, or 19,456 cubic meters (m^3).

A summary of the annual quantity of waste disposed at both the New Liskeard and Haileybury Landfills from 1997 to 2008 is provided on Table 2. It should be noted that these estimates of historical annual waste volumes were recorded prior to disposal and compaction by the landfill operators.

2.4 Project Needs – Planning Period, Waste Densities and Long-Term Solid Waste Disposal Volume

As stated in Section 1.1, the overall goal of this project is to identify the most feasible option for establishing new landfill capacity for long-term solid waste disposal. Based on AMEC's discussions with the City, a long-term solid waste disposal planning period of 30-years was chosen. For the purposes of this report, the 30-year planning period begins in January 2009 and extends to December 2039. This planning period provides the basis for the calculation of projected long-term waste disposal quantities.

Table 3 presents a projection of the quantities of waste generated by the communities forming City of Temiskaming Shores over the 30-year planning period. These communities include Haileybury, Dymond, Cobalt and New Liskeard. The projections were based on the following:

- Linear extrapolations of population growth calculated from 1991, 1996, 2001 and 2006 census data, as provided by Statistics Canada for the City of Temiskaming Shores and the Town of Cobalt;
- Uncompacted waste quantity estimates for 2008, as presented above in Section 2.3; and
- Uncompacted waste generation estimates of 2.6 m^3 per capita for the communities of Haileybury, Cobalt and Dymond (combined) and 3.9 m^3 per capita for the former Town of New Liskeard.

Table 3c presents projections for the generation of uncompacted residential solid waste for the City of Temiskaming Shores, representing the sum of the projected waste generation estimates from Tables 3a and 3b. McBean, et. al. (1995) indicates that the density of uncompacted residential solid waste generally ranges from 90 kilograms per cubic metre (90 kg/m^3) to 180 kg/m^3, with a typical value of 150 kg/m^3. For the purposes of this report, it is assumed that the uncompacted residential waste generated by the City will have a density of 150 kg/m^3. As such, Table 3c presents the calculation of the tonnage of projected waste generated per year by multiplying the volume of uncompacted solid waste by a density of 150 kg/m^3 and dividing the result by a factor of 1 tonne to 1,000 kg.

As discussed in the Existing Sites Report, AMEC observed that waste disposed at the Haileybury Landfill was subjected to compaction using a HL760 front end loader. Although the actual densities of the compacted waste material at the New Liskeard and Haileybury Landfills

are not known, McBean, et. al., (1995) indicates that the density of residential solid waste after landfill compaction generally ranges from 445 kg/m^3 to 505 kg/m^3. For the purposes of this report, the in-place density of residential solid waste after landfilling and compaction will be conservatively estimated at 300 kg/m^3, representing an increase from the uncompacted residential waste density by a factor of two. Thus, on Table 3c the volume of compacted residential waste is calculated by multiplying the tonnage of projected waste generated by a factor of 1,000 kg to 1 tonne and dividing the result by an in-place density of 300 kg/m^3.

The results presented on Table 3c indicate that the City of Temiskaming Shores (including the Township of Cobalt) is projected to cumulatively generate approximately 699,073 m^3 of compacted solid waste during the 30-year planning period. As stated in Section 2.2.3, although the City does administer the operation of an MRF for the management of recyclable waste, the MRF has limited capacity to accommodate the increased volume of recycled material generated by the City due to amalgamation. As such, this report conservatively assumes that, based on the current condition of the MRF, the volume of residential waste diverted by collection of recycle materials will be negligible throughout the planning period. Therefore any long-term solid waste management alternative developed by the City will have to accommodate a long-term solid waste disposal volume of approximately 699,073 m^3 of compacted residential waste.

It should be noted that typically, landfill operations in Ontario require that daily cover soil be applied on solid municipal waste at a ratio of 4:1 (waste to daily cover soil), representing approximately 20% of typical landfill capacity. Given a projected long-term solid waste disposal volume of approximately 699,073 m^3, the total landfill capacity of waste and daily cover soil is calculated as follows:

$$TC = 699{,}073\ m^3 \times R_{TOTAL}/R_{WASTE}$$
$$= 699{,}073\ m^3 \times [(4+1)/4]$$
$$= 699{,}073\ m^3 \times 5/4$$
$$= 873{,}841\ m^3$$

Where: TC = Total Capacity of projected solid waste generated;
R_{TOTAL} = Total Ratio of solid waste and daily cover soil; and
R_{WASTE} = Ratio of solid waste.

The overall project waste and daily cover soil needs for the 30 year planning period are summarized in Table 4. A review of Table 4 indicates that any long-term solid waste management alternative developed by the City will be required to accommodate approximately 874,000 m^3 (rounded value) of landfill volume, including waste and daily cover soil quantities, as of January 2009.

As discussed in the Existing Sites Report any long-term solid waste management strategy for the City would include the use of the remaining approved landfill capacity at the existing landfills. Section 3.3.2 of the Existing Sites Report indicated that the Haileybury Landfill is the only existing site within the City boundaries with remaining landfill capacity. The Remaining

Site Capacity at the Haileybury Landfill is estimated as approximately 188,691 m^3, including waste and daily cover soil.

As such the estimated capacity of the required landfill alternative would be calculated by the subtraction of the Remaining Site Capacity at Haileybury Landfill from the Long-term Landfill (Waste & Cover Soil) Volume Requirement. Therefore the Preliminary Design Landfill Capacity is 685,150 m^3 (873,841 m^3 - 188,691 m^3), which is rounded to approximately 685,000 m^3 for the purposes of this report. The Preliminary Design Landfill Capacity can be multiplied by the in-place density of 300 kg/m^3 to obtain an estimated landfill mass of 205,500 metric tonnes.

3.0 DESCRIPTION OF NEW LISKEARD LANDFILL SITE

AMEC's understanding of the condition of the New Liskeard Landfill is based on the review of the documents listed in Section 2.0. Additionally, AMEC conducted a visual inspection of the New Liskeard Landfill on 17 and 18 September 2009.

3.1 Site Description

The New Liskeard Landfill is situated approximately 1 km west of Highway 11 along the north side of Rockley Road in Dymond Township. The legal description of the landfill location, as presented on C of A No. A571505 (Appendix A), is the west half of Lot 5, Concession 2 in the Corporation of the Town of New Liskeard. This site is located approximately 3 km west of the former Town of New Liskeard, as shown on Figure 1. The total property area is 32 ha, of which 2.02 ha are approved for landfill operations but a total of approximately 5 ha have been landfilled.

As shown on Figure 2 the landfill area is located centrally within the property. The landfill property access is from the south gate located along Rockley Road. A series of granular haul roads have been constructed on the site, one running from the gate adjacent to the west property boundary, one running south and east of the landfill and one running over the capped landfill area towards the most recent active disposal area. Stockpiles of waste tires, white goods, inert construction rubble (steel and concrete), clay, Wabi slag and sand are found to the west and northwest of the landfill area. Stockpiles of recycled glass and reclaimed asphalt are located towards the southwest near the entrance gate. A bedrock outcrop is located north of the landfill area.

3.2 History of Site Approvals

The New Liskeard Landfill was purchased by the former Town of New Liskeard in 1916 and the land was used for waste deposition soon thereafter (SRQ, May 2004). The landfill's original Certificate of Approval expired in 1976, prompting new investigations at the landfill to facilitate the application for a new Provisional Certificate of Approval (SRQ, May 2004). There is limited information available on the operation of the landfill between the years 1976 and 1978. SRQ (May 2004) reports that in 1978, the Ministry of Environment (MOE) warned the Town of New Liskeard as to the potential issuance of a formal order regarding the operation of the New Liskeard Landfill, although, in a letter dated 10 November 1978, the MOE agreed to withhold the order if the following conditions of landfill operations were met:

- Municipality to commission an "in-depth" study to determine the extent of leachate migration within and outside the landfill boundary;
- Prohibition of all on-site burning activities;
- Maintain a minimum 25-yard (23-m) "working face";
- Municipality to purchase any property affected by landfill leachate; and
- Municipality to investigate the use of bentonite cut-off walls to control leachate migration.

In 1979, the former Town of New Liskeard commissioned a phased hydrogeological investigation of the landfill site, which was completed in 1980 (SRQ, May 2004). The results of the investigation indicated that leachate was detected approximately 300 m to 400 m northeast from the toe of the landfill; however, the report indicated that the leachate was not impacting any downgradient groundwater users (SRQ, May 2004). The resulting report recommended that the Town of New Liskeard purchase property within 500 m of the north and east landfill boundary, an area designated as the contaminant attenuation zone (CAZ).

Between 1979 and 1980, the former Town of New Liskeard commissioned the preparation of landfill operation documentation, which was submitted to the MOE to secure the issuance of Provisional C of A No. A571501, dated 11 December 1980. It should be noted that although a topographic survey was completed in 1980 in support of the C of A application, the information available at that time provides no indication of the limits of the 2.02 ha area approved for landfill operations (SRQ, May 2004). In 1999, the MOE conducted an inspection of the New Liskeard landfill. The MOE inspection report indicated that the landfill was operating beyond the approved limits, estimating that landfilled waste was deposited in an area of approximately 4 ha rather than the approved 2.02 ha. The MOE report also indicated that groundwater monitoring had not been conducted since 1983 and that the recommended CAZ had not been purchased by the Town of New Liskeard. The MOE recommended that an Emergency C of A and Environmental Assessment were required.

In order to comply with the MOE's recommendations, the former Town of New Liskeard commissioned a new hydrogeological investigation, as well as topographic surveys to delineate the extent of the approved 2.02 ha landfill area, to delineate the limit of the waste deposited outside of the approved area and to determine the amount of waste deposited at the landfill. Figure 2 presents the limits of the approved 2.02-ha landfill area, as well as the extent of the waste deposited beyond the approved landfill area. The estimate of the Total Site Capacity quantity for the New Liskeard Landfill was not provided in any of the background documentation provided to AMEC by the City, although SRQ reports that in 2004 the Total Remaining Site Capacity of the New Liskeard Landfill Site was approximately 49,580 m^3, including waste and waste cover soil (SRQ, May 2004).

Subsequently, the former Town of New Liskeard purchased the land adjacent to the east landfill property boundary for use as a CAZ. A revised C of A No. A571505 was issued on 9 May 2000 (SRQ, May 2004) outlining the disposal of domestic, commercial and non-hazardous solid industrial waste at the New Liskeard Landfill within an approved 2.02-ha landfill area. C of A No. A571505 was amended on 27 April 2005 after amalgamation. This amendment changed the name of the landfill owner from "The Corporation of the Municipality of New Liskeard" to "The Corporation of the City of Temiskaming Shores", as well as revised the landfill's service area to the municipal boundary of the City of Temiskaming Shores, which includes the communities of New Liskeard, Haileybury and Dymond Township, as well as the Town of Cobalt. C of A No. A571505 was again amended on 17 April 2007 to include the November 2005 application for Provisional C of A and a figure showing the CAZ in the Schedule "A" list of landfill operating documents.

3.3 Adjacent Land Use

Land use

The New Liskeard Landfill property is bordered by undeveloped forest lands to the north, northwest and west. HydroOne electric transmission power line right-of-ways are located along the north and west boundaries. Lands used for agricultural purposes are located to the southwest, south and southeast, with single family residences, farm buildings and pasture lands located on either side of Rockley Road. An Ontario Ministry of Transportation equipment building is located to the southeast of the landfill property. The land directly to the east of the landfill property is unused forested lands owned by the City, which is designated as the CAZ.

A bedrock outcrop is located adjacent to the northern portion of the landfill and is presumed to run to the south directly beneath the fill area. Landfill operations early on in the history of the site involved depositing waste on the east side of the bedrock ridge (SRQ, May 2004). As discussed in Section 3.5, it is presumed that the bedrock ridge forms a divide between subsurface flows on the west side of the landfill.

Sensitive Land Uses

Within 500 m of the New Liskeard Landfill property, there are several domestic water supply wells located along Rockley Road southeast of the landfill. Additional domestic water supply wells are located along Highway 65 just beyond the 500-m distance from the landfill. There are no surface water features or any known natural sensitive areas within 500 m of the site (JHL, May 2008).

Transportation/ Access

The New Liskeard Landfill property is accessed from Rockley Road located south of the property. A granular haul road extends to the north from the site entrance gate to a loop located adjacent to waste material (i.e. tires, white goods, inert construction debris) stockpiles placed immediately south of the bedrock outcrop. A granular site haul road is also located immediately south of the landfill limit, running towards the east and then turning north along the east property boundary. As shown on Figure 1 the New Liskeard Landfill is located approximately 3 km west of the former Town of New Liskeard, approximately 4 km southwest of the former Town of Dymond, approximately 9 km northwest of the former Town of Haileybury and approximately 20 km north of the Town of Cobalt.

Ecology (Habitat and Species)

With the exception of agricultural lands south of the site, the surrounding area comprises undeveloped natural flora with mostly forested areas containing immature to mature vegetation. Observations during the September 2009 landfill inspections indicate that the fauna in these natural areas is represented by species commonly found in undeveloped lands in northern Ontario in close proximity to a human settlement.

3.4 Physical Site Setting and Geology

The Temiskaming Shores area is known as the Little Clay Belt, a large glaciolacustrine clay plain deposited by Lake Barlow during the Late Pleistocene within the Temiskaming Rift Valley created by a series of faults. Surrounded and bounded at depth by igneous and metamorphic rocks of the Precambrian Shield, the deposits of the rift valley include dolostones, limestones, shales and sandstones up to 310 m thick overlying the Precambrian rocks and Quaternary overburden overlying the sedimentary rocks. The Quaternary units include a basal diamicton overlain by glaciofluvial sand and gravel, and glaciolacustrine varved clay. The sand and gravel deposits form important regional aquifers with thicknesses of up to 30 m or more (KPC, June 2003).

The New Liskeard Landfill is located at the south edge of the rift valley on top of a bedrock ridge. A groundwater divide is presumed to be present at the top of the ridge. The waste is located just east of this groundwater divide along the northeast portion of the bedrock ridge and sits directly on top of limestone bedrock or very thin overburden of silt till to sandy gravel (JHL, May 2008). The land topography from the waste slopes down to the northeast and the overburden thickness gradually increases towards the fault running northwest-southeast near Highway 65. The overburden thickness ranges approximately from 0 to 2 m below ground surface (BGS) near the landfill and gradually increases towards the northeast with a significant increase in thickness on the other side of the fault up to approximately 23 m BGS with a sand and gravel aquifer at depth used by numerous water supply wells along Highway 65.

3.5 Hydrogeology

Jagger Hims Limited (JHL) reported that the groundwater table in the plains area of the CAZ ranged from 0.4 m BGS to 3.2 m BGS (JHL, May 2008). In 2007, the average depth to static water level at the bedrock ridge was 4.2 m BGS in shallow bedrock and 8.8 m BGS in deep bedrock. Source area observation well OW-18, which is located at the highest point within the landfill and is constructed to approximately 15.2 m BGS, has consistently been observed to be dry. Immediately downgradient of the landfill footprint to the northeast, the water table is approximately 3.5 m BGS.

Groundwater flows through the overburden and through the upper bedrock from the landfill to the northeast. JHL reported that highly fractured bedrock extended to 10 m BGS at OW-1R (northeast edge of waste footprint), which corresponds to approximately the upper 7 m of the limestone bedrock (JHL, May 2008). Other boreholes indicated more fractured bedrock in the upper 1 to 2 m of bedrock relative to deeper bedrock. Strong downward hydraulic gradients have been reported on the bedrock ridge and below the landfill, indicating that the landfill is located in a groundwater recharge area. This is to be expected since the site is located just east of the presumed groundwater divide at the top of the bedrock ridge. The vertical hydraulic gradients level out to nearly horizontal downgradient of the landfill. At the eastern boundary of the CAZ, upward vertical hydraulic gradients were observed, towards the intermediate overburden (JHL, May 2008).

The CAZ, owned by the City, extends approximately 500 m downgradient of the northeast edge of the waste footprint. Average groundwater flow velocity in the plains area northeast of the landfill was reported by JHL to be approximately 1.9 m/year in overburden and ranging from 0.6 to 5.7 m/year in shallow bedrock (JHL, May 2008).

3.6 Hydrology

The New Liskeard Landfill is situated on a well-drained, limestone ridge, which forms a drainage divide separating the South Wabi Creek catchment to the west and the Wabi River catchment to the east. The current waste fill zone lies within the Wabi River watershed, however, no significant surface water bodies are located within 500 m of the New Liskeard Landfill. JHL reported one or two intermittent, poorly defined channels at the northeast corner of the CAZ (JHL, May 2008). The nearest surface water bodies to the New Liskeard Landfill are South Wabi Creek located approximately 900 m to the west and Wabi River located approximately 2 km northeast.

3.7 Monitoring Program

An extensive groundwater monitoring network of observation wells has been established at the New Liskeard Landfill. Some of the observation wells have been reported to be damaged. There are no surface water monitoring stations because there is no surface water body to monitor in the vicinity of the landfill. The monitoring program is conducted three times per year and includes the measurement of groundwater levels and collection of groundwater samples for analysis of general chemistry and metal parameters (JHL, May 2008). Groundwater samples are also collected once a year at 8 domestic wells along Highway 65.

The groundwater monitoring network was first established at the landfill in 1980 by the installation of 23 observation wells, each in a separate borehole. The wells were constructed with 40-mm inside diameter Schedule 40 ABS pipes, with screening reported as being in the “bottom few metres” (JHL, May 2008). These wells were designated with A for shallow, B for intermediate and C for deep installations. Additional wells were installed from 2000 to 2007 and were designated with "I" for deep, "II" for intermediate and "III" for shallow installations. The historical groundwater monitoring network is summarized below:

Overburden		Shallow Bedrock	Deep Bedrock	Source
OW-1A/OW-1R-III	OW-16-III	OW-1B/OW-1R-II	OW-1C/OW-1R-I	OW-18
OW-2A	OW-17-I	OW-2B	OW-2C	
OW-3A	OW-17-II	OW-3B	OW-7C	
OW-4A	OW-17-III	OW-8B		
OW-5A	OW-19-I	OW-9B		
OW-6A	OW-19-II	OW-10-I		
OW-7A	OW-20-I	OW-11-I		
OW-8A	OW-20-II	OW-12-I		

Overburden		Shallow Bedrock	Deep Bedrock	Source
OW-9A	OW-21-I			
OW-10-II	OW-22-I			
OW-10-II	OW-23-I			
OW-11-II	OW-23-II			
OW-12-II	OW-24-I			

Selected groundwater monitoring well locations in the immediate vicinity of the landfill are shown on Figure 2.

3.8 Groundwater Quality

JHL reports that a leachate-affected groundwater plume extends from the New Liskeard Landfill to the northeast. Shallow groundwater quality in 2007 was affected by leachate at monitor wells OW-11 and OW-12 located at the property boundary between the landfill and the CAZ. The leachate plume did not appear to extend to monitor wells OW-16, OW-17, OW-24 and OW-25 at the northeast boundary of the CAZ, although potentially intermittent and negligible effects were noted for some parameters, suggesting these monitors are located just beyond the fringe of a “compliance boundary” (JHL, May 2008).

In 2004, water quality samples were last collected from private water supply wells located along Rockley Road southeast of the landfill property. Sample results indicated that these wells were not impacted by leachate (JHL, May 2008). Given that groundwater flow on the landfill property flows away from these private wells to the northeast, no leachate impacts to these wells are expected in the future. The private water supply wells along Highway 65, approximately 900 m downgradient from the landfill and beyond the CAZ, were reported not to be impacted by leachate in 2007 (JHL, May 2008).

Concentrations of leachate indicator parameters (boron, chloride, DOC, potassium, sodium, sulphate and TDS) in samples collected from the landfill’s monitoring wells have remained steady over time from 2000 to 2007, indicating that the subsurface groundwater chemistry has attained steady state (JHL, May 2008).

3.9 Preliminary Groundwater Model

Based on the presence of numerous fractures in the subsurface, the presence of fault zones, and the absence of a significant low permeability confining layer overlying the bedrock, as reported by JHL, there is a high susceptibility for leachate migration to the bedrock aquifer. Leachate infiltration into the deeper bedrock from beneath the landfill can also be attributed to the high vertical hydraulic gradients reported by JHL, as indicated by high concentrations of indicator parameters (boron, chloride, DOC, potassium, sodium, sulphate and TDS) in samples collected from deep bedrock well OW-1R. JHL reports that the concentration of chloride in a sample collected from OW-1R was measured at 350 milligrams per litre (mg/L) (JHL, May

2008). Monitoring well OW-1R extends to approximately 20 m BGS into deep bedrock. In downgradient monitor wells, higher concentrations of indicator parameters are usually found in the shallow overburden or bedrock than in the deeper overburden or bedrock. This indicates that although the leachate plume may extend to the deep bedrock beneath the landfill, horizontal and upward hydraulic gradients farther downgradient of the landfill result in groundwater flowing progressively more horizontally and then upward from deeper to intermediate layers of overburden and shallow bedrock. The majority of groundwater flow occurs in the overburden and shallow bedrock.

3.10 Contaminant Attenuation Zone

As reported in Section 3.8, the presence of leachate indicator parameters were not observed in samples collected from monitoring wells located at the northeast boundary of the CAZ. JHL reports that the existing CAZ is currently sufficient for the existing volume of solid waste landfilled at New Liskeard (JHL, May 2008). This conclusion is based on the following observations:

- steady concentration trends of indicator parameters were observed in the groundwater monitoring samples from 2000 to 2007, and

- no leachate impacts have been reported in the groundwater samples collected downgradient of the CAZ.

In order to confirm JHL's conclusion that the CAZ is sufficient for the natural attenuation of the existing condition of the landfill's leachate plume, AMEC conducted a conceptual assessment of the dilution capacity of the CAZ using the concentrations of the leachate indicator chloride. This preliminary assessment was described in the Existing Sites Report. The following revised assessment improves upon some of the initial assumptions used in the conceptual assessment through improved estimates of surface areas of the existing New Liskeard Landfill and downgradient attenuation zone (including landfill property and CAZ) from updated preliminary design drawings. The revised areas and climatic information from the Earlton Airport weather station were used in the Thornthwaite Method (Thornthwaite and Mather 1955) to calculate revised infiltration rates through the landfill and the CAZ. The input parameters for the revised assessment are based on the following factors:

- Existing Footprint Area – The surface area of the existing New Liskeard Landfill, based on the existing surface contours, is estimated to be 60,000 square meters (m^2) or 6 ha.

- Upgradient Infiltration Rate – Field observations indicated that the New Liskeard Landfill is located just east of a groundwater divide. Historical data indicates that the majority of the first groundwater recharging the subsurface is from beneath the landfill. Therefore, it is assumed that there is negligible dilution of the leachate plume beneath the landfill due to upgradient surface water infiltration.

- Source Area Infiltration Rate - Climate data from the Earlton Airport Climatological Station near Temiskaming Shores indicate a 30-year (1971 to 2000) mean annual precipitation in the area of 785 millimetres per annum (mm/a) and a mean potential evapotranspiration rate of 505 mm/a. Using the Thornthwaite Method, the actual evapotranspiration rate for the existing landfill was calculated to be 239 mm/a, yielding a mean water surplus of 546 mm/a available for runoff and groundwater recharge. The New Liskeard Landfill has been reportedly covered with an interim (soil and clay) cover; however, its extent is unknown. Therefore, a silt fill material was assumed and an infiltration rate (I_L) of 19 mm/a was calculated for the existing landfill footprint.

- Downgradient Recharge Area - Based on the available distance from the northeast edge of the existing landfill to the northeast edge of the CAZ, the surface area of the available attenuation zone downgradient of the landfill was measured as approximately 200,000 m^2 (20 ha).

- Downgradient Infiltration Rate - Using the Thornthwaite Method, the actual evapotranspiration rate for the existing available downgradient attenuation zone was calculated to be 387 mm/a, yielding a mean water surplus of 398 mm/a available for runoff and groundwater recharge. The downgradient attenuation zone, including the CAZ, is covered by silt till overburden. An infiltration rate of 69 mm/a was calculated for the downgradient attenuation zone. This infiltration rate, I_{CAZ}, is applied at the CAZ downgradient of the landfill.

The assessment of the existing CAZ (the downgradient attenuation zone) begins with the calculation of the source area and downgradient groundwater recharge rates from the above noted factors. The source area (i.e. existing landfill area) recharge rate is calculated as follows:

$$Q_L = A_L \times I_L$$
$$= 60{,}000\ m^2 \times 0.0191\ m/a$$
$$= 1{,}140\ m^3/a$$

Where: Q_L = Landfill recharge rate;
A_L = Landfill footprint surface area; and
I_L = Landfill footprint infiltration rate

Similarly, the downgradient CAZ recharge rate is calculated as follows:

$$Q_{CAZ} = A_{CAZ} \times I_{CAZ}$$
$$= 200{,}000\ m^2 \times 0.069\ m/a$$
$$= 13{,}800\ m^3/a$$

Where: Q_{CAZ} = Downgradient CAZ recharge rate;
A_{CAZ} = Downgradient CAZ surface area; and
I_{CAZ} = Downgradient CAZ infiltration rate.

As reported in Section 3.5, groundwater/leachate from the source (i.e. landfill) area generally flows downgradient to the northeast through the CAZ. As such, any groundwater recharge located downgradient of the landfill will serve to dilute the leachate generated within the landfill footprint. The dilution factor of the downgradient groundwater recharge can be calculated as follows:

$$DF = Q_{CAZ} / Q_L$$
$$= 13{,}800\ m^3/a\ /\ 1{,}140\ m^3/a$$
$$= 12.1$$

Where: DF = downgradient dilution factor;
Q_{CAZ} = Downgradient CAZ recharge rate; and
Q_L = Landfill recharge rate.

Expected vs. Actual Downgradient Chloride Concentrations

In 2003, a leachate sample was collected from well OW-18 located within the landfill footprint. The concentration of chloride in the leachate sample was reported as 1,220 mg/L (JHL, May 2008). Using a dilution factor of 12.1, as calculated above, the expected chloride concentration at the northeast boundary of the CAZ is calculated as approximately 101 mg/L (i.e. 1,220 mg/L divided by 12.1). This concentration is below the Ontario Drinking Water Standard (ODWS) of 250 mg/L for chloride and below the chloride Reasonable Use Concept (RUC) criterion of 127.9 mg/L used by JHL for the Site (JHL, May 2008.

Analytical data from the Site indicate that the chloride concentrations at the northeast boundary of the CAZ range from 3 mg/L in deep overburden to 26 mg/L in shallow overburden (JHL, May 2008). These analytical concentrations are reportedly similar to the concentrations found in the background/upgradient monitoring wells and are significantly less than the expected chloride concentration of 101 mg/L. For the purposes of this report, the background concentration of chloride will be conservatively assumed to be 20 mg/L.

JHL reports that in 2007, chloride was detected at a concentration of 100 mg/L in a sample collected from OW-12 located approximately 175 m downgradient of OW-18 at the property boundary of the CAZ (JHL, May 2008). At that time, this was the highest detected chloride concentration in a downgradient monitoring well representing a reduction from the leachate chloride concentration of 1,220 mg/L in the landfill. Based on the observed data and the fact that groundwater chemistry from 2000 to 2007 has remained at steady state at the Site, an attenuation factor, AF, can be calculated as follows:

$$AF = (Cl_{SOURCE} - Cl_{DOWN}) / D_{ATT}$$
$$= (1{,}220\ mg/L - 100\ mg/L) / 175\ m$$
$$= 6.4\ mg/L/m$$

Where: AF = CAZ attenuation factor;
Cl_{SOURCE} = Chloride concentration from source monitoring well;
Cl_{DOWN} = Maximum chloride concentration from a downgradient well; and

D_{ATT} = Attenuation distance between source area and downgradient well.

Based on the above attenuation factor, the required attenuation distance, D_{ATT}, for chloride, and by extension, the leachate plume, from the source area chloride concentration of 1,220 mg/L to an assumed background chloride concentration of 20 mg/L is calculated as follows:

$$D_{ATT} = (Cl_{SOURCE} - Cl_{DOWN}) / AF$$
$$= (1{,}220 \text{ mg/L} - 20 \text{ mg/L}) / 6.4 \text{ m}$$
$$= 187.5 \text{ m}$$

The current downgradient attenuation zone, including the landfill property and the CAZ, extends approximately 550 m downgradient of the northeast edge of the landfill, which is three times greater than the calculated required attenuation distance of 187.5 m.

Therefore, given that the chloride concentrations from downgradient monitoring wells are significantly less that the expected chloride concentration of 101 mg/L and the downgradient distance of the existing attenuation zone within the CAZ is greater than the calculated required attenuation distance of 187.5 m, it can be concluded that the existing CAZ is sufficient to address current leachate impacts and will likely continue to be sufficient for the existing waste footprint.

4.0 DESCRIPTION OF HARLEY TOWNSHIP LANDFILL

AMEC's understanding of the condition of the Harley Township Landfill is based on the review of the C of A No. A571702, under which the landfill operates, and the *Municipal Groundwater Study, Central Temiskaming* Area (KPC, June 2003). Additionally, AMEC conducted a visual inspection of the Harley Township Landfill on 18 February 2010.

4.1 Site Description

The Harley Township Landfill is located on the south part of the northeast quarter of Lot 12, Concession 1 in Harley Township, District of Temiskaming. It is located on the west side of Sale Barn Road and south of Hanbury Road, approximately 2 km east of Highway 11 and about 10 km north of the Town of New Liskeard (Figure 1). The landfill operates as a small-scale trench-style waste disposal site.

The landfill area is located on the northern half of the property. The landfill property access is from the east gate located at Sale Barn Road. A series of granular haul roads have been constructed on the site. Stockpiles of waste tires, white goods, underground storage tanks, household waste and clay were found at the landfill. A recycling depot with large bins was found along the access road to the landfill.

4.2 History of Site Approvals

The property has apparently been in use as a landfill since 1978. The Harley Township Landfill currently operates under amended C of A No. A571702, dated 6 May 2005, as amended, which approves the use and operation of 8.1 ha of landfilling area within a total property area of 16.2 ha. This C of A specifies the service area and does not contain any conditions pertaining to the management or monitoring of leachate, landfill gas, groundwater or surface water. C of A No. A571702 is provided in Appendix C.

4.3 Adjacent Land Use

Land use

The Harley Township Landfill site property is bordered by undeveloped forest lands on all sides, with agricultural land farther to the west towards Highway 11 and towards the east near Sutton Creek. Single family residences or commercial operations are scattered along the surrounding roads with the nearest residence approximately 500 m south of the landfill on Sale Barn Road and another residence at approximately 600 m.

Sensitive Land Uses

No Environmental Protection Zones, Hazard Zones or Sensitive Areas are located within 500 m of the Harley Township Landfill site. There are no surface water features and no domestic wells within 500 m of the site.

Transportation/ Access

The Harley Township Landfill property is accessed from Sale Barn Road located within 250 m to the east of the property. A granular haul road extends to the west and south from the entrance gate to the landfill area. The property is located approximately 10 km north of New Liskeard just north of the boundary of the City of Temiskaming Shores.

Ecology (Habitat and Species)

The surrounding area comprises undeveloped natural flora with mostly forested areas containing immature to mature vegetation. Observations during the February 2010 landfill inspection indicate that the fauna in these natural areas is represented by species commonly found in undeveloped lands in northern Ontario in close proximity to a human settlement. No significant terrestrial or aquatic habitats were identified in the vicinity of the landfill.

4.4 Physical Site Setting and Geology

The Harley Landfill is located in the middle of the Temiskaming Rift Valley on top of a bedrock ridge and groundwater divide, which separates the Wabi River Valley to the southwest and the Blanche River Valley to the northeast. The property is located on the northeast side of the bedrock ridge on relatively level terrain. The topography in the area slopes from approximately 271 meters above sea level (masl) at the top of the ridge located about 800 m southwest of the site to 187 masl about 1.5 km northeast of the site. A steep drop in topography occurs about 600 m northeast of the site along an escarpment.

The bedrock beneath the landfill property comprises sandstone, limestone and dolostone of the Thornloe Formation and Earlton Formation from the Silurian Period, which are underlain by limestone, dolostone and shale of the Liskeard Group from the Ordovician Period (KPC, June 2003). These sedimentary rocks are underlain by the igneous and metamorphic rocks of the Precambrian Shield. The Quaternary overburden beneath the landfill property comprises glaciolacustrine clays and silts. Regional mapping indicates that the bedrock surface beneath the landfill property is less than 25 m below ground surface (BGS). This overburden thickness could be considerably less since the landfill is located on top of a bedrock ridge. The overburden thickness increases from the top of the bedrock ridge southwest of the landfill property to the northeast into the Blanche River Valley.

4.5 Hydrogeology

The Harley Township Landfill is located on the northeast part of the bedrock ridge, which acts as the groundwater divide between the Wabi River catchment to the southwest and the Blanche River catchment to the northeast. As such, the Harley Township Landfill property is within the Blanche River catchment, within a groundwater recharge area and groundwater beneath the site would be expected to flow to the northeast (KPC, June 2003). The potentiometric surface elevation was reported by KPC (June 2003) to range from 210 to 230 masl in the vicinity of the landfill property. Therefore, the groundwater depth may be expected to range from 20 to 40 m BGS. A detailed hydrogeologic field investigation (i.e. monitoring wells) would be needed to confirm actual groundwater levels beneath the site.

4.6 Hydrology

The Harley Township Landfill is situated on a well-drained, limestone ridge, which forms a drainage divide separating the Wabi River catchment to the southwest and the Blanche River catchment to the northeast. The landfill property lies within the Blanche River watershed; however, no significant surface water bodies are located within 500 m of the Harley Township Landfill. The nearest major surface water body is Lake Temiskaming approximately 5 km to the southeast. In closer proximity are a number of drainage channels originating from the escarpment 600 m northeast of the landfill property and probably represent groundwater discharge. These drainage channels drain to a wetland in the valley below, which drains into the larger Hilliardton Swamp farther east. Hilliardton Swamp is drained by Sutton Creek to Lake Temiskaming. The drainage channels may be intermittent. A detailed hydrogeological field investigation would be needed to confirm the extent and permanence of this groundwater discharge.

4.7 Preliminary Groundwater Model

Based on the limited available information as described above, the following preliminary groundwater model has been developed for the Harley Township Landfill. The landfill property is located in a groundwater recharge zone near the top of a bedrock ridge. Groundwater beneath the property is expected to flow to the northeast into the Blanche River watershed. Some groundwater discharges onto the land surface along the escarpment located approximately 600 m northeast of the landfill property and drains into a small wetland, which is drained farther east to the Hilliardton Swamp. Therefore, any leachate impacted groundwater plume would also travel to the northeast and some portion of the plume could discharge into the drainage channels identified at the escarpment. The fine-grained nature of the clays and silts of the overburden beneath the landfill may provide some degree of protection from any leachate impacts to the groundwater at depth. However, this depends on factors such as the depth to groundwater, depth of overburden, depth to bedrock and the degree of fracturing within the upper bedrock.

4.8 Contaminant Attenuation Zone

Leachate management at the Harley Landfill is anticipated to be completed through natural attenuation processes within an established CAZ. Given the current lack of hydrogeological data to support the calculation of a site-specific CAZ, the evaluation of the site was based on a generic CAZ sizing formula based on the waste footprint, the resultant land area and whether the CAZ would intersect typical groundwater receptors (i.e. other uses or groundwater discharge zones such as lakes, streams, rivers or wetlands). The proposed CAZ is 8 times the waste deposit length, including 1 length in the upgradient area and 6 lengths in the downgradient area, and 3 waste deposit widths. A visual representation of the CAZ for the Harley Landfill is presented on Figure 3. This results in a CAZ that extends approximately 250 m upgradient, 250 m to each crossgradient side of the landfill and 1.5 km downgradient of the landfill to the northeast. A small part of this CAZ would include some of the groundwater discharge drainage channels identified on regional mapping and the south part of the small wetland located beyond the escarpment. The total size of the proposed CAZ is 148 ha.

5.0 PRELIMINARY LANDFILL DEVELOPMENT DESIGN ALTERNATIVES

The following sections present a discussion on the preliminary design basis for the development of long-term landfill disposal capacity for the City of Temiskaming Shores. The designs presented herein represent the preferred conceptual alternatives considered for additional landfill capacity over the 30 year planning period.

In the Existing Sites Report, four conceptual landfill expansion alternatives were developed for additional landfill capacity at City owned landfill sites, two alternatives for the New Liskeard Landfill and two alternatives for the Haileybury Landfill. These options were evaluated against feasibility assessment criteria and ranked and the preferred option for expansion was the alternative outlining development of additional waste deposition space to the east of the existing New Liskeard Landfill Footprint.

In the New Sites Report, a total of four conceptual design alternatives were developed for the establishment of a new landfill site. Two conceptual design alternatives were developed for properties located within the municipal boundary, and two conceptual design alternatives were developed for properties located outside of the municipal boundary but within a 10 km study zone. These options were ranked and scored against the same feasibility assessment criteria used in the Existing Sites Report, and the preferred selected alternative involved the establishment of additional landfill capacity at the Harley Township's existing landfill property.

Details on the selection of the preferred conceptual landfill alternatives can be found in the Existing and New Sites Reports.

5.1 Preferred Conceptual New Liskeard Landfill Expansion Design

During the September 2009 Landfill Inspections, AMEC observed that the New Liskeard Landfill property had open areas to the east and to the west of the existing landfill footprint which would be available for potential expansion. Expansion to the north of the landfill footprint was limited on the basis that it would be difficult to develop land adjacent to the limestone escarpment located in that area. Additionally, AMEC observed that there were clear, long sightlines to and from the former Town of New Liskeard and the surrounding lands from the limestone escarpment, thus recognizing the potential future value property as a setting for a recreational/parkland once the landfill was closed. The limited availability of land to the south of the landfill footprint minimized the possibility of expansion in that direction.

As shown on Figure 2 the lands to the east of the New Liskeard Landfill are generally open, with grasses and low lying vegetation covering the surface. The land generally slopes downward toward the northeast with surface elevations ranging from 254 meters above sea level (masl) to 245 masl. AMEC observed stockpiles of foundry sands and wood debris (i.e., brush and branches) in that area. A granular access road runs from the north to the south, adjacent to the east property boundary.

The lands to the west of the New Liskeard landfill are generally forested. Stockpiles of reclaimed asphalt, recycled glass, foundry sands, scrapped spare tires, white goods and concrete debris are stored along the west granular haul road. The land is generally level with elevations ranging from 270 masl to 271 masl.

The preferred Conceptual New Liskeard Landfill Expansion Design involves the construction of the landfill expansion to the east of the current footprint of the Site and west of the established CAZ. The key parameters of this conceptual expansion design are presented on below:

Parameter	Value
Additional Footprint Area	2.61 ha
Base Elevation	254 masl
Top Elevation	280 masl
Additional Landfill Capacity (inc. waste & daily cover)	687,600 m^3

5.2 New Liskeard Landfill – Preliminary Landfill Expansion Design

For the purposes of this report, the preferred conceptual landfill expansion design for the New Liskeard Landfill was refined to a preliminary level of detail. The additional detail provided includes establishing landfill buffer zones, developing landfill base contours, developing landfill final cover contours and generating a more detailed estimate of waste, daily cover and final cover quantities. This preliminary design also offers additional detail relating to the establishment of primary surface water, leachate and landfill gas controls for the proposed expansion. Finally, present value estimates of capital costs for the construction of the proposed expansion over the 30 year planning period was developed based on the parameters of this preliminary design.

It should be noted that the preliminary design herein was developed based on currently available knowledge of the physical, hydrogeological and hydrological conditions of the New Liskeard Landfill, as outlined in Section 3.0. It is understood that design parameters and design elements may change based on further technical study of the proposed New Liskeard Landfill property. The preliminary design parameters and preliminary cost estimates herein are provided for the purposes of feasibility evaluation only. It is recommended that a detailed level design be developed to provide a basis for regulatory approval of the proposed landfill expansion, and that the detailed design be based on additional technical study of the surface, subsurface, hydrogeological and hydrological condition of the landfill property. It is also recommended that detailed level cost estimates for budgetary use be developed based on a finalized detailed design of the proposed landfill expansion.

5.2.1 Preliminary Design Criteria

The key components of the preliminary landfill expansion design include the following:

- buffer zones;
- base contours;
- final contours and cover layer construction;
- landfill capacity and daily cover soil volumes;
- groundwater/leachate management (i.e., establishing a CAZ);
- surface water management; and
- landfill gas management

The design criteria for these features are based on standards provided by the MOE in the *Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfills Sites*, dated May 1998 and henceforth referred to as the "Landfill Standards". The Landfill Standards outline the requirements presented in Ontario Regulation 232/98 (O.Reg. 232/98) for new and expanding landfills. The standards for existing landfill sites are outlined in Ontario Regulation 347 (O. Reg. 347).

O.Reg. 232/98 sets a minimum requirement for the size of a buffer area between the waste fill area and the property boundary for a landfill. The purpose of the buffer area is to provide an area for contaminant attenuation and provide space around the landfill perimeter for monitoring, maintenance and environmental control activities. As stated in Section 4.2 of the Landfill Standards, the minimum requirement for the size of the buffer area is "at least 100 meters wide at every point" or "at least 30 meters wide at every point" if the buffer area provides adequate space for vehicle access, site structures, equipment and activities and that the buffer is sufficient to ensure potential effects of the landfilling operation do not have any unacceptable impacts outside the site. For the purposes of this preliminary design, the minimum size of the buffer zone will be 30 m between the landfill property boundary and the limit of landfill waste.

The base contours for the proposed preliminary design of the New Liskeard Landfill expansion will be developed to ensure that the quantity of soil excavated will be equivalent to the quantity of soil required for daily cover for the deposited waste and to ensure that the base provides a suitable hydrogeologic setting (i.e., soil type and depth to groundwater table, etc.). As stated in Section 2.4, landfill operations in Ontario require that daily cover soil be applied on solid municipal waste at a ratio of 4:1 (waste to daily cover soil), representing approximately 20% of typical landfill capacity.

For the purposes of this report, the maximum elevation of the proposed final cover will be equivalent to the highest elevation of the existing landfill, which is approximately 280 masl. In accordance with O.Reg. 232/98 and Section 6.11 of the Landfill Standards, the final cover of the propose landfill expansion will be constructed of a minimum 600 mm thick layer of relatively impermeable clay soils overlaid by a minimum 150 mm thick layer of topsoil and vegetative cover. Section 6.12 of Landfill Standards outline that the final above grade slopes of the landfill

area should not exceed 4 units horizontal to one unit vertical (i.e., 4:1 slope) and should not be less than 20 units horizontal to 1 unit vertical (i.e., 20:1 slope).

As stated in Section 2.4, any long-term solid waste management alternative developed by the City will be required to accommodate approximately 874,000 m^3 (rounded value) of landfill volume, including waste and daily cover soil quantities. Any long-term solid waste management alternative will include the use of the remaining landfill capacity at the Haileybury Landfill. In the Existing Sites report it was estimated that the Remaining Site Capacity at the Haileybury Landfill is estimated as approximately 188,691 m^3, including waste and daily cover soil. Therefore the preliminary design landfill expansion capacity is 685,150 m^3 (873,841 m^3 - 188,691 m^3), which is rounded to approximately 685,000 m^3 for the purposes of this report. Assuming that the landfill expansion will have a waste to daily cover soil ratio of 4:1, the corresponding estimated quantity of daily cover soil is approximately 177,000 m^3.

It is assumed on a preliminary design basis that the proposed New Liskeard Landfill expansion will be operated as a natural attenuation landfill, as is currently the case for the existing landfill. As such, the preliminary design for groundwater protection will be developed using a site specific approach. The Landfill Standards allow the use of a site specific approach for groundwater/leachate management provided the Reasonable Use Criteria (RUC) limits for groundwater protection are met.

Section 4.9 of the Landfill Standards outline that surface water controls at landfill sites are constructed to ensure that drainage onto or leaving the site does not adversely affect landfill operations or adjacent surface water facilities. The objectives of surface water controls are to divert surface water runoff coming onto the site, to control runoff discharging from the site and to control erosion, sedimentation and flooding. As stated in Section 3.6 of this report, the New Liskeard Landfill is situated on a well-drained, limestone ridge, with no significant surface water bodies located within 500 m of the property. For the purposes of this feasibility study, surface water controls will be limited to establishing perimeter drainage ditches around the limit of waste to control drainage, and the establishment of a final landfill cover with a maximum slope of 4:1 to limit erosion and sedimentation transport.

In June 2008, the Ministry of Environment amended O. Reg. 347 and O.Reg. 232/98 to present requirements for landfill gas collection and management for new, expanding and operating landfills. The amendments are presented in the MOE's *Landfill Gas Capture: A Guideline on the Regulatory and Approval Requirements for Landfill Gas Capture Facilities*, dated September 2008 (Landfill Gas Guideline). The Landfill Gas Guideline states systems to control the atmospheric emission of landfill gas are required for landfills with capacities larger than 1.5 million cubic meters. It is anticipated that the volume of the New Liskeard Landfill, including the proposed expansion will be less than the 1.5 million cubic meter criteria. As such no landfill gas collection and management systems are proposed as part of this preliminary design.

Table 5 presents a summary of the above noted minimum criteria, which provides the basis for the preliminary design of the landfill expansion at the New Liskeard Landfill.

5.2.2 Buffer Zones

Figure 4 presents a site plan of the New Liskeard Landfill showing the preliminary design base contours for the proposed landfill expansion. Also shown is the limit of waste for the proposed expansion and the existing landfill areas. As indicated on Figure 4, the minimum buffer zone size of 30 m is established between the limit of waste and eastern landfill property boundary which is the closest boundary to the landfill. The buffer distance between the north, west and southern property boundaries and the limit of landfill waste is 150 m, 65 m and 100 m, respectively. As such the size of the buffer zone surrounding the existing landfill and the proposed landfill expansion satisfies the minimum 30 m criteria provided on Table 5 and in Section 5.2.1.

It should be noted that approximately that the City owns approximately 28 ha of land on the east side of the existing landfill property, which is currently used as the CAZ. This land serves as an buffer zone between the landfill's limit of waste and the boundary of the CAZ.

5.2.3 Base Contours

As shown on Figure 4, the elevations of the proposed base contours range from 258 masl at the existing ground surface to 244 masl at the base of the landfill. The side slopes of the landfill base are no greater than 2:1 while the base grade is approximately 2% to the east.

A three dimensional analysis of the proposed preliminary design base contours and final contours were completed using Autodesk AutoCAD Civil 3D. Based on a comparison of the "current" landfill contours shown on Figure 2 and the proposed preliminary design base contours shown on Figure 4, the estimated quantity of native soil excavated to achieve the base contours is approximately 219,00 m^3. As discussed in Section 5.2.5, estimated capacity of the landfill is approximately 884,000 m^3, for waste and daily cover soil only. Using a ratio of 4:1 (waste to daily cover soil), the estimated quantity of daily cover soil required is 177,000 m^3. The estimated amount of soil to be excavated (219,000 m^3) is greater that the estimated quantity of required daily cover soil (177,000 m^3), therefore the base contours satisfy the minimum criteria for the preliminary design as provided on Table 5 and in Section 5.2.1.

5.2.4 Final Contours

Figure 5 presents a site plan of the New Liskeard Landfill showing the preliminary design final contours for the proposed landfill expansion. These contours include the application of a final cover consisting of minimum 600 mm thick clay initial cover layer and minimum 150 mm thick vegetated topsoil layer over the landfill's waste/daily cover soil. As shown on Figure 5, the preliminary design of the landfill cover has a minimum slope of 20:1 on the top plateau of the landfill, while the landfill's side slopes are designed at a maximum grade of 4:1. As such the proposed preliminary design of the landfill expansion's final cover layer satisfies the minimum criteria outlined on Table 5 and in Section 5.2.1.

5.2.5 Waste, Daily Cover & Final Cover Quantities

A three dimensional analysis of the proposed preliminary base contours and final contours were completed using Autodesk AutoCAD Civil 3D. Civil 3D compares the two contours and generates an estimate of the volume between two surfaces. To facilitate the estimate of final cover volume, AMEC also generated three dimensional surfaces representing the 150 mm thick vegetated topsoil layer, the 600 mm thick clay initial cover layer and the top of the landfill's waste/daily cover soil surface. Based on Civil 3D analysis, the waste, daily cover and final cover quantities are estimated as follows:

- Landfill waste quantity = 707,000 m^3;
- Landfill daily cover soil quantity = 177,000 m^3;
- 600 mm thick clay initial cover layer quantity = 57,000 m^3; and
- 150 mm thick vegetated topsoil quantity = 14,000 m^3.

The estimated landfill waste and daily cover soil quantities exceed the criteria presented on Table 5 and in Section 5.2.1, indicating that based on the preliminary design configurations, the capacity of the proposed landfill expansion is greater than the capacity required based on the project needs calculations presented on Table 4 and in Section 2.4.

It should be noted that the combined estimate of landfill waste and daily cover soil is approximately 884,000 m^3 (i.e., sum of = 707,000 m^3 and 177,000 m^3). As outlined on Table 5, the minimum Preliminary Design Landfill Expansion Capacity criteria is 685,000 m^3 based on the assessment of project needs on Table 4 and Section 2.4. As such, the proposed preliminary design for the landfill expansion exceeds the criteria by approximately 199,000 m3 (i.e., 884,000 m^3 minus is 685,000 m^3). The increase in capacity represents a potential expansion of the landfill's operating life by approximately 10 years, based on the projected waste generation rate for 2009 (as presented on Table 3c).

5.2.6 Groundwater/Leachate Management

The New Liskeard Landfill has historically operated as a natural attenuation landfill and groundwater/leachate impacts were managed through the purchase of approximately 28 ha of land to the east of the landfill property to act as a contaminant attenuation zone. For the purposes of the proposed preliminary design of the landfill expansion, it will continue to be operated as a natural attenuation landfill. Figure 6 presents the configuration of the current CAZ.

A conceptual assessment of the existing CAZ was performed in the Section 6.3.4 of the Existing Sites Report. The purpose of this assessment was to determine if the existing CAZ would be sufficient to manage any additional impacts introduced by the proposed expansion of the New Liskeard Landfill. The following revised assessment improves upon some of the initial assumptions used in the conceptual assessment by using improved Civil 3D estimates of surface areas of the proposed preliminary design of the New Liskeard Landfill expansion. The revised surface areas and climatic information from the Earlton Airport weather station were

used in the Thornthwaite Method (Thornthwaite and Mather 1955) to calculate revised infiltration rates through the expanded landfill and the reduced CAZ. The input parameters for the revised assessment are based on the following factors:

- Expanded Footprint Area - The total surface area of the proposed New Liskeard expanded landfill is 109,000 m^2 (10.9 ha). This includes the existing landfill (part of which will be re-graded and recapped) and the additional waste to be placed northeast of the existing landfill.

- Reduced Downgradient Recharge Area - Since the expansion occurs onto the downgradient side of the landfill, the downgradient recharge area is reduced from the current recharge area of 200,000 m^2 by the expanded landfill area of 59,000 m2 to 141,000 m^2 (14.1 ha).

- Expanded Source Area Infiltration Rate – Using the Thorthwaite Method, an infiltration rate (I_L) of 14.3 mm/a was calculated for the expanded New Liskeard Landfill. This infiltration rate is less than the infiltration rate of 19 mm/a calculated for the existing landfill because the clay cover of the expanded landfill was incorporated into the calculation.

- Downgradient Infiltration Rate – The infiltration rate (I_{CAZ}) of 69 mm/a for the downgradient attenuation zone in the CAZ would not change.

Based on the above factors, the expanded landfill footprint (i.e. source area) recharge rate is calculated as follows:

$$Q_{L\,EXP} = A_{L\,EXP} \times I_L$$
$$= 109{,}000\ m^2 \times 0.0143\ m/a$$
$$= 1{,}559\ m^3/a$$

Where: $Q_{L\,EXP}$ = Recharge rate within the expanded landfill footprint;
$A_{L\,EXP}$ = Total expanded landfill footprint surface area; and
I_L = Landfill footprint infiltration rate.

Similarly, the recharge rate for the downgradient CAZ area is calculated as follows:

$$Q_{CAZ\,EXP} = A_{CAZ\,EXP} \times I_{CAZ}$$
$$= 141{,}000\ m^2 \times 0.069\ m/a$$
$$= 9{,}729\ m^3/a$$

Where: $Q_{CAZ\,EXP}$ = Downgradient CAZ recharge rate;
$A_{CAZ\,EXP}$ = Downgradient CAZ surface area; and

I_{CAZ} = Downgradient CAZ infiltration rate.

Assuming that groundwater recharges downgradient of the landfill in the CAZ and dilutes the migrating leachate plume, the expanded dilution factor is:

$$\text{Dilution Factor, } DF_{EXP} = Q_{CAZ\ EXP} / Q_{L\ EXP}$$
$$= 9{,}729\ m^3/a\ /\ 1{,}559\ m^3/a$$
$$= 6.2$$

Where: DF = downgradient dilution factor;
$Q_{CAZ\ EXP}$ = Downgradient CAZ recharge rate; and
$Q_{L\ EXP}$ = Landfill recharge rate.

As stated in Section 3.10, the chloride concentration of the leachate is 1,220 mg/L as measured in source area well OW-18. Using the dilution factor of 6.2, the expected chloride concentration at the northeast boundary of the CAZ for the expanded landfill would be 197 mg/L (1,220 mg/L divided by 6.2). This concentration is above the chloride RUC criterion of 127.9 mg/L used by Jagger Hims (2008) for the Site but below the chloride ODWS of 250 mg/L. Therefore, using the infiltration method for the expanded New Liskeard Landfill, the expected downgradient chloride concentration would exceed the RUC at the northeast CAZ compliance boundary.

However, as previously indicated for the existing landfill, this approach significantly overestimated the degree and extent of groundwater impact downgradient of the landfill. As shown in Section 3.10 and based on actual historical data, it was estimated that a distance of approximately 187.5 m from the edge of the landfill is required to attenuate the leachate plume to background concentrations (based on actual chloride concentrations). The infiltration calculations, although overestimating the observed impact, did indicate that the degree and extent of downgradient impact for the expanded landfill may be twice that of the existing landfill at steady state (i.e. expected downgradient chloride concentration of 197 mg/L for the expanded landfill vs. expected downgradient chloride concentration 101 mg/L for the existing landfill). Therefore, if it is conservatively assumed that the attenuation distance of the leachate plume from the edge of the landfill will also double as a result of the additional waste, the required distance for attenuation of the leachate plume in the subsurface would be 2 x 188 m = 376 m. This is still within the 400 m of the CAZ downgradient of the east property boundary, although it would likely extend beyond the north side of the existing CAZ.

In summary, it is recommended that the existing CAZ be expanded to the north by approximately 50 m to 100 m, resulting in the requirement to obtain approximately 2 ha to 4 ha of additional land to ensure a minimum 400 m attenuation distance. Figure 7 presents the configuration of the expanded CAZ required to fulfill the preliminary design criteria presented on Table 5 and Section 5.2.1.

This revised assessment of the existing CAZ was based on surface areas, types of surface soils and climate normals. A more detailed assessment of the required CAZ for the expanded New Liskeard Landfill is recommended in the detailed design if this site is chosen as the preferred landfill alternative.

5.2.7 Surface Water Management

Due to the minimal historical surface water impacts observed at the New Liskeard Landfill, surface water management features presented as part of the preliminary design of the proposed landfill expansion include the establishment of a 500 m long perimeter drainage ditch between the proposed limit of waste and the proposed perimeter access roads. The purpose of this perimeter ditch will be to divert surface water runoff coming onto the site, to control runoff discharging from the site. The ditches will be graded to direct surface water runoff to a culvert located in the north east corner of the landfill limit, which will facilitate surface runoff drainage beneath the proposed access road. Additionally surface water drainage on the completed landfill surface will be managed through the grading and establishment of a vegetated topsoil layer on the landfill's final surface to limit erosion and sediment transport. Figure 4 presents the configuration of perimeter drainage ditch, and Figure 5 presents the configuration of the final cover grades required to fulfill the preliminary design criteria presented on Table 5 and Section 5.2.1.

5.2.8 Landfill Gas Management

As discussed in Section 5.2.1, MOE amended O. Reg. 347 and O.Reg. 232/98 to require that landfill gas management systems be installed for landfills with capacities larger than 1.5 million cubic meters. Based on Autodesk AutoCAD Civil 3D analysis of the contours of the existing New Liskeard Landfill and assuming an inferred existing base contour based on the ground surface elevations adjacent to the existing limit of waste the Total Site Capacity of the existing New Liskeard Landfill is estimated as approximate 431,000 m^3. It should be noted that conceptual level cross-section calculations performed on the existing landfill footprint for the Existing Sites Report estimated that a Total Site Capacity of approximately 392,000 m^3, which essentially confirms the revised Civil 3D estimate.

Given that the Total Site Capacity of the existing landfill is approximately 431,000 m^3 and the total waste/daily cover soil quantity of the proposed landfill expansion is 884,000 m^3, the total waste/daily cover soil quantity of the New Liskeard Landfill, including the proposed expansion is estimated as 1,315,000 m^3 (i.e., sum of 431,000 m^3 and 884,000 m^3). This is less than the 1.5 million cubic meters criteria outlined on Table 5 and Section 5.2.1, therefore, for the purposes of this report, it is assumed that landfill gas collection or management systems will not be required.

5.2.9 Preliminary Design Capital Construction Cost Estimate

The capital construction cost estimates for the preliminary design of the New Liskeard Landfill Expansion is based on the following assumptions:

1. Long-term landfill disposal strategy includes the on-going disposal of the City's municipal solid waste at the Haileybury Landfill in the years 2009 to 2016 during the 30-year planning period;

2. Construction of the proposed landfill expansion base contours, final cover, perimeter access road and perimeter drainage ditching occurs progressively throughout the 30-year planning period; and

3. Capital construction costs will be subject to inflation during the 30-year planning period.

Based on assumption No. 1, it is anticipated that the City will begin incurring capital construction costs for the proposed landfill expansion in 2015, reflecting that this would be the latest the City should begin construction activities assuming approval under the Environmental Assessment Act and Environmental Protection. For the purposes of this report, capital construction costs are calculated using present value methods to account for the progressive, sequential development of the proposed landfill cell. To account for the uncertainty do to the preliminary nature of the design, the cost estimates presented herein are provided in a range of "Low" and "High" values, rather that a single averaged value.

Sequential Development of Proposed Landfill Expansion

The progressive construction of the landfill expansion will allow the City to accommodate both landfilling and landfill closure operations in parallel as well as to manage and offset the capital costs incurred during construction of the proposed landfill expansion throughout the 30-year planning period.

As shown on Figures 4 and 5, the proposed landfill expansion is divided in the Cells 1 though 5, representing that construction of the expansion will occur in separate phases. In each phase, new base surfaces, perimeter access roads and perimeter drainage ditches will be constructed in prepared areas to facilitate progressive landfilling and closure of landfill areas prior to the next phase.

For the purposes of this report, it is assumed that the construction of the proposed landfill expansion will begin in the south portion of the site at Cell 1. Once Cell 1 approaches landfill capacity, construction activities will begin in Cell 2 and proceed northward. Upon completion of cell construction and the initiation of landfill activities in Cell 2, Cell 1 will be closed and a final cover will be applied to limit leachate generation. This sequence would be essentially repeated for cells 3, 4 and 5. The sequential development of the propose landfill expansion is generally outlined as follows:

Phase 1 (Years 2009 to 2015)

- On-going landfilling at Haileybury Landfill;
- Obtain land rights for the expansion to the CAZ in 2015; and
- Construction of Cell 1 base and associated perimeter access roads/drainage ditches beginning in 2015.

Phase 2 (Years 2016 to 2020)

- Closure construction of the Haileybury Landfill beginning in 2016;
- Landfilling of Cell 1 to capacity; and
- Construction of Cell 2 base and associated perimeter access roads/drainage ditches beginning in 2020.

Phase 3 (Years 2021 to 2025)

- Closure construction of Cell 1 beginning in 2021;
- Landfilling of Cell 2 to capacity; and
- Construction of Cell 3 base and associated perimeter access roads/drainage ditches beginning in 2025.

Phase 4 (Years 2026 to 2030)

- Closure construction of Cell 2 beginning in 2026;
- Landfilling of Cell 3 to capacity; and
- Construction of Cell 4 base and associated perimeter access roads/drainage ditches beginning in 2030.

Phase 5 (Years 2031 to 2035)

- Closure construction of Cell 3 beginning in 2031;
- Landfilling of Cell 4 to capacity; and
- Construction of Cell 5 base and associated perimeter access roads/drainage ditches beginning in 2035.

Phase 5 (Years 2036 to 2039)

- Closure construction of Cell 4 beginning in 2036;
- Landfilling of Cell 5 to capacity; and
- Closure construction of Cell 5 beginning in 2039.

Determination of Inflation Rate

For the purposes of this report, the Non-Residential Building Construction Price Index (NRBCPI) will be used for estimating an interest rate for the preliminary design capital construction cost estimate. The NRBCPI is commonly used to calculate interest rates for Financial Assurance calculations for waste disposal sites since NRBCPI measures the changes in contractors' selling prices of non-residential building construction (i.e., commercial, industrial and institutional), and it relates to both general and trade contractors' work while excluding the

cost of land, design and real estate fees. The NRBCPI is generated by regional metrics, however, it can be argued that the use of a NRBCPI for Toronto would not accurately represent the costs incurred at sites located outside of the Greater Toronto Area (for example, locations in Northern Ontario).

In February 2008, the MOE document titled *Approved Procedures for Deriving Inflation and Discount Rates for FA Calculations*, dated February 2008 (see Appendix D). This document provides updated derivation procedures for inflation and interest (discount) rates in present value cost calculations. The updated derivation procedures allow the use of a floating 10-year Average Ontario Non-Residential Building Construction Price Index (AONRBCPI) to represent all Ontario sites, which is a combination of the floating 10-year average NRBCPI's from the Greater Toronto Area and the Ontario part of the Ottawa-Gatineau Area. For the purposes of this preliminary design capital construction cost estimate, the AONRBCPI was used to derive the inflation rate.

Table 6 presents a listing of the most recent the quarterly and average annual NRBCPI for the Greater Toronto Area and the Ottawa-Gatineau Area from 1999 to 2009. The average annual NRBCPI values are combined in order to calculate the AONRBCPI representative of all Ontario sites. The floating 10-year AONRBCPI values are used to calculate the required annual inflation rate.

The following equation can be used to determine the future worth of any present value over a given time period [Lindeberg, 1996]:

$$F = P(1+i)^n$$

The same equation can be modified to determine the average inflation rate (i) over a given period, as follows:

$$i = \left(\frac{F}{P}\right)^{\frac{1}{n}} - 1$$

Where: F = the most recent average AONRBCPI (= 282.5 for the year 2009);
P = the AONRBCPI for 10 years prior previous year (= 208.4 for the year 1999); and
n = floating 10-year period (= 10)

Using the above relationship with all available data from Statistics Canada, the annual average change in AONRBCPI for Ontario corresponding to the 10-year period between January 1,

1999 and December 31, 2009 is calculated to be 3.23%. Therefore, an inflation rate of 3.23% is used to calculate the preliminary design capital construction cost estimate.

It should be noted that although the determination of an interest rate for use in these present value calculations is based on a method commonly used to calculate Financial Assurance, MOE regulations do not require the provision of Financial Assurance for landfill sites owned by municipalities such as the City of Temiskaming Shores. As such, no Financial Assurance estimates are required for the proposed expansion of the New Liskeard Landfill.

Table 3 presents a summary of the (rounded) decommissioning cost estimates, post-closure care cost estimates and required inflation rate.

Present Value Capital Construction Cost Estimates (Low)

Table 7 presents a breakdown of the capital construction costs associated with the acquisition of additional land for the expansion of the CAZ and the construction of one cell of the proposed landfill expansion.

The unit costs presented on Table 7 represents typical low estimates for each construction activity, based on AMEC's experience with landfill construction, tender and contract administration for similar landfill expansions. For land acquisition costs, the quantity of the proposed CAZ expansion is estimated at 2 ha, representing the lowest area recommended, as outlined in Section 5.2.6. It should be noted that the cost estimate provided on Table 7 are presented in values of 2010 Canadian Dollars ($CAD).

Table 8 presents the present value calculation of the capital construction cost estimate for the proposed landfill expansion, based on the sequencing plan outlined above, and the low estimates of unit costs provided on Table 7. As such, the present value capital construction cost (low) for the proposed expansion of the New Liskeard Landfill is approximately $3,962,000 in 2010 $CAD.

Present Value Capital Construction Cost Estimates (High)

Table 9 presents a breakdown of the capital construction costs associated with the acquisition of additional land for the expansion of the CAZ and the construction of one cell of the proposed landfill expansion.

The unit costs presented on Table 9 represents typical high estimates for each construction activity, based on AMEC's experience with landfill construction, tender and contract administration for similar landfill expansions. For land acquisition costs, the quantity of the proposed CAZ expansion is estimated at 4 ha, representing the lowest area recommended, as outlined in Section 5.2.6. It should be noted that the cost estimate provided on Table 9 are presented in values of 2010 $CAD.

Table 10 presents the present value calculation of the capital construction cost estimate for the proposed landfill expansion, based on the sequencing plan outlined above, and the high estimates of unit costs provided on Table 9. As such, the present value capital construction cost (low) for the proposed expansion of the New Liskeard Landfill is approximately $8,356,000 in 2010 $CAD.

5.3 Preferred Conceptual Harley Township Landfill Development Design

Landfill development for the Harley Township Landfill involves the construction of the landfill at the existing Harley Township Landfill Site. A schematic of the conceptual design for Harley Township Landfill is presented in Figure 3. The key parameters of this conceptual design are presented below:

Parameter	Value
Footprint Area	6.07 ha
Base Elevation	250.5 masl
Top Elevation	277 masl
Landfill Capacity (inc. waste & cover)	685,000 m^3

5.4 Harley Township Landfill – Proposed Landfill Expansion Conceptual Design Basis

The conceptual design basis for the Harley Township Landfill is dependent on two main factors:

1. The City of Temiskaming Shores does not own the Harley Township Landfill; and

2. There is very little technical information available on the condition of the Harley Township Landfill.

The available technical information for the Harley Township Landfill was discussed and summarized as part of the New Sites Report and was used to the develop the conceptual design presented on Figure 3. In April 2010, the City initiated discussions with Harley Township to define an agreement to proceed with the disposal of City generated wastes at the Harley Township Landfill during the 30-year planning period. These discussions include requests for acquiring existing technical information or developing additional technical information through a hydrogeological study of the landfill property.

As such, it is assume the preliminary design of any proposed expansions to the Harley Township Landfill will be developed by Harley Township, not the City of Temiskaming Shores.

5.4.1 Preliminary Capital Costs

Based on some of the discussions between the City and Harley Township, the capital cost estimates for the expansion of the Haileybury Landfill is based on the following assumptions:

1. Long-term landfill disposal strategy includes the on-going disposal of the City's municipal solid waste at the Haileybury Landfill in the years 2009 to 2016 during the 30-year planning period;

2. Regulatory approval, design and construction of the proposed landfill expansion will be prepared by Harley Township and not the City of Temiskaming Shores; and

3. The City will be charged an access fee to the Harley Township Landfill, as well as a per tonne tipping fee ($25 to $35 per tonne) for disposal of the City's waste during the remaining years 2017 to 2039 of the 30-year planning period.

The present value cost estimates for the expansion of the Harley Township Landfill presented herein are based on low and high estimates of the access and tipping fees.

Present Value Capital Cost Estimates (Low)

Table 11 presents a breakdown of the low end capital costs associated with obtaining access to the Harley Township Landfill and payment of landfill disposal tipping fees to Harley Township during the one year of the 30-year planning period. For the purposes of this cost estimate, it is assumed that the design landfill expansion capacity for the Harley Township Landfill will accommodated the approximately 685,000 m^3 of landfill waste/daily cover generated by the City during the 30-year planning period, as outlined on Table 4. As such, the tonnage of landfill waste generated per year between 2017 and 2039 (i.e., 21 years) is calculated as follows:

$$W_{ANNUM} = (685{,}000\ m^3 / 21\ \text{years}) \times D_{IN\text{-}PLACE}$$
$$= 32{,}619\ m^3/\text{year} \times 300\ kg/m^3 \times 1\ \text{tonne} / 1{,}000\ kg$$
$$= 9{,}786\ \text{tonnes}$$

Where: W_{ANNUM} = the projected tonnage of waste generated by the City per year; and
$D_{IN\text{-}PLACE}$ = the assumed in-place compacted density of solid waste and daily cover soil (i.e., 300 kg/m^3)

The unit costs presented on Table 11 represents low end estimates for each activity. It should be noted that the cost estimate provided on Table 11 are presented in values of 2010 Canadian Dollars ($CAD).

Table 12 presents the present value calculation of the capital cost estimate for the proposed Harley Township Landfill expansion, based on the low estimates of unit costs provided on Table 11. As such, the present value capital cost (low) for the proposed expansion of the Harley Township Landfill is approximately $10,139,000 in 2010 $CAD.

Present Value Capital Construction Cost Estimates (High)

Table 13 presents a breakdown of the high end capital costs associated with obtaining access to the Harley Township Landfill and payment of landfill disposal tipping fees to Harley Township during the one year of the 30-year planning period. For the purposes of this cost estimate, it is assumed that the design landfill expansion capacity for the Harley Township Landfill will accommodated the approximately 685,000 m^3 of landfill waste/daily cover generated by the City during the 30-year planning period, as outlined on Table 4. As such, the tonnage of landfill waste generated per year between 2017 and 2038 (i.e., 21 years) is calculated similar as indicated above. The unit costs presented on Table 13 represents high end estimates for each activity. It should be noted that the cost estimate provided on Table 13 are presented in values of 2010 Canadian Dollars ($CAD).

Table 14 presents the present value calculation of the capital cost estimate for the proposed Harley Township Landfill expansion, based on the high estimates of unit costs provided on Table 13. As such, the present value capital cost (low) for the proposed expansion of the Harley Township Landfill is approximately $14,220,066 in 2010 $CAD.

6.0 FEASIBILITY ASSESSMENT CRITERIA

The process of assessing the feasibility of the preliminary landfill expansion alternatives for the New Liskeard and Harley Township Landfills will be conducted based on the evaluation and ranking of each preliminary landfill expansion against a set list of feasibility criteria to determine a preferred expansion scenario (i.e., the most feasible alternative). The criteria used for both steps are derived from the following sources:

- Environmental Protection Act, Regulation 347 General-Waste Management (O. Reg. 347);
- Ontario Regulation 232/98 (O.Reg. 232/98) for new and expanding landfill sites
- Town of Haileybury Zoning By-law No. 85-27, November 1985;
- Township of Dymond By-law No. 1041, March 1986;
- Official Plan for the Town of Haileybury, March 1989;
- Official Plan for the Town of New Liskeard, March 1989; and,
- Town of New Liskeard Zoning By-law No. 2233, June 1989.

AMEC generated a list of key criteria for the assessment of the feasibility of the preliminary landfill alternatives based on a review of the documentation listed above. The purpose of the feasibility criteria is to assess the overall impact of the preliminary landfill expansion alternatives to the members of the community, the surrounding environment and the municipality. The key criteria are:

- Public Health, Safety and Socioeconomic Factors;
- Natural Environment;
- Preliminary Technical Considerations; and,
- Preliminary Capital Cost Estimates.

The following presents a discussion of each of these key criteria as well as the sub-criteria which will be ranked to assess a preferred preliminary landfill expansion alternative. The list of feasibility criteria is summarized on Table 15.

6.1 Public Health & Safety and Socioeconomic Factors

This key criterion mainly addresses the potential impact the conceptual landfill expansion alternatives will have on the nearby community. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Distance to Residential Areas;
- Distance to Sensitive Land Uses;
- Distance to Drinking Water Supply Wells; and,
- Distance to Waste Generation Source and Road/Transport Access.

Distance to Residential Areas

The distance between a landfill footprint and adjacent residential areas are referenced in several regulatory sources. Section 13 of O. Reg. 347 requires that a landfill fill area be at least 0.25 mile (400 m) from any existing residence. Section 5.3 of the MOE's *Guideline D-4 Land Use On or Near Landfills and Dumps* (Guideline D-4), dated April 1994 recommends that a 500 m study area be established around landfill areas to evaluate the presence and impact of any adverse effects or risks to health and safety. However, Sections 5.3 and 4.4 of Guideline D-4 does consider that the actual perimeter distance of the study area may be set at less than or greater than 500 m based on the determination of the limit of the environmental impacts. Section 7, of O. Reg. 232/98 (for new or expanding landfill sites) outlines the requirement of a 100 m buffer area around the waste fill area of the landfill site or a minimum of 30 m at every point of the buffer area if there is adequate space for site access, parking, surface water management facilities structures and that the buffer area is sufficient to ensure that potential impacts of the landfill operation to the outside are minimal.

The various municipal by-laws for the various towns that form the City of Temiskaming Shores also reference distances between waste disposal facilities and residential areas. These references are summarized as follows:

Town of Haileybury, Zoning By-law No. 85-27, November 1985

- Article 2.23 - Setbacks from Waste Disposal Sites requires that no building or structure shall be constructed or expanded closer than 30 meters to the perimeter of an operational waste disposal site.

Town of Haileybury Zoning By-law No. 85-27 Nov 1985

- Article 2.23 requires that no building or structure shall be constructed or expanded closer than 30 m to the perimeter of the area which is to be landfilled on an operational waste disposal site.

Township of Dymond By-law No. 1041, March 1986

- The by-law requires that landfills cannot be located in Environmental Protection (EP) zones.

As a result, each preliminary landfill expansion alternative will be evaluated based on the distance between the landfill and the closest residence.

Distance to Sensitive Land Uses

Section 13 of Reg. 347 references the following restrictions to locating landfill sites near sensitive land uses:

- Section 13(1) - The fill area shall not be subject to flooding and shall be so located that no direct drainage leads to a watercourse;
- Section 13(2) - The landfill shall be at least one-quarter of a mile (400 m) from the nearest dwelling;

- Section 13(3) - The landfill shall be at least two hundred yards (182 m) from the nearest public road;
- Section 13(4) - The site shall be at least 100 feet (30 m) from any watercourse, lake or pond; and,
- Section 13(5) - The site shall not be on land covered by water.

The following excerpts from the City's municipal by-laws and official plans further define limitations to development of sensitive lands:

Township of Dymond By-law No. 1041, March 1986

- Section 14(1) outlines that the only allowed non-residential uses for EP (Environmental Protection) zones are for an archaeological site; conservation use; farm, other that a building; flood control and erosion use; forestry use; marine facility; and outdoor recreational use, other than a building; a wildlife and fish management use; and
- Section 16(5)(n) requires that where a non-agricultural land use is establishing or expanding in close proximity to existing livestock buildings; or where livestock facilities are being constructed, enlarged or remodeled near an existing non-agricultural use the separation distance between the existing use and proposed use shall be the distance prescribed by the Minimum distance Separation formula of the Agricultural Code of Practice as revised from time to time.

Township of Dymond Official Plan Amendment No. 2, November 1996, Section 1- General Provisions:

- Agriculture 1.4.1 - Class 2 and 3 soils as defined by the Canada Land Inventory of soil Capability for Agriculture are considered to be of prime importance and will be protected. Non-farm development in areas of good agricultural capability will not be permitted; and,
- 1.10 Hazard Land and Sensitive Areas – It is the intent of this Plan to prevent development from occurring on lands having an inherent environmental hazards such as poor drainage, flood susceptibility, erosion, steep slopes or any other physical condition which could endanger human life and property.

In order to evaluate potential conflicts of the proposed landfill development alternative, the feasibility of each alternative will be assessed by the number of residences within 400 m of the center of the landfill, the distance to the nearest agricultural land, distance to the nearest EP Zone, and the distance to hazard lands and sensitive areas.

Distance to Drinking Water Supply

There are no restrictions to the placement of water supply wells around established landfill sites in O. Reg. 347 or O. Reg. 232/98, as groundwater impacts are to be managed within the designed buffer area and attenuation zone. In September 1986, the MOE introduced a policy to assist in the evaluation of groundwater impacts, especially for the case of landfill and/or lagoon operations. The policy was entitled "The Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities" and is referred to now as Guideline B-7 (formerly Policy 15-08) or the "Reasonable Use" policy. Simply stated, the policy sets groundwater contaminant discharge criteria for landfills and/or lagoons that may impair local water quality;

the criteria are based on maintaining the protection of groundwater resources on the adjacent lands or properties.

Guideline B-7 requires that contaminant discharge criteria, representing the maximum acceptable levels of contaminants that should not be exceeded, be established using a simple mathematical relationship that incorporates background (existing) water quality and the highest provincial water quality standards for the adjacent land use. Under Guideline B-7, water quality impacts will not be allowed to exceed the maximum calculated discharge criteria at the landfill (or Site) property boundaries.

In order to apply Guideline B-7, the appropriate resource use of the adjacent properties must be selected. At both proposed landfill development sites, the highest end use for groundwater on the adjacent properties is for drinking water purposes, for which the Ontario Drinking Water Standards (ODWS) - Table 1 through Table 4 have been established. The purpose of the ODWS is to protect public health through the provision of safe drinking water. Water intended for human consumption shall not contain unsafe concentrations of toxic chemicals (health related parameters). Health related standards are established for parameters that, when present above a certain concentration, have known or suspected adverse health effects. At the same time, water should also be aesthetically acceptable. Colour, odour and turbidity are parameters that, when controlled, result in water that is clear, colourless and without objectionable or unpleasant taste or odour (non-health related parameters). In addition, operational guidelines have been established for non-health related parameters that need to be controlled to ensure efficient and effective treatment and distribution of the water. As well, Guideline B-7 requires the identification of background water quality conditions in the underlying aquifer.

In order to establish the background geochemical profile, the geometric mean of the valid concentrations of each applicable ODWS parameter would have to be calculated, and the resultant values applied along with the ODWS, to complete a Guideline B-7 analysis for all of the on-Site groundwater monitoring wells for various landfill indicator parameters.

As each preliminary landfill expansion alternative will be developed as a natural attenuation site, the feasibility of the expansion alternatives will be compared to the water well related criteria, specifically pertaining to the presence of any designated drinking water supply areas (i.e., Wellhead Protection Areas) and distance to the nearest drinking water supply well.

Distance to Waste Generation Source and Road/Transport Access

The Official Plans for the City of Temiskaming Shores do not contain any special provisions to protect rural areas. The rural area covers areas within the City where no further urban development is contemplated by the Plan and where further municipal services will be restricted to those needed to deal with emergencies. Land designated as Rural Use is intended primarily for agriculture, forestry, recreational or conservation purposes. The purpose of the Rural Use designations to prevent uncontrolled and scattered development. Further in order to prevent the conflicts that may result when development occurs in areas that are not adequately supplied with services and other public works and to avoid excessive costs for such works in the future, it

is the intent of Council to maintain the rural area at a similar level to the now prevailing and to restrict further development to a minimum.

As such, the distance to waste centroid/waste generation source and the distance to nearest existing road will be used to evaluate the feasibility of landfilling at each site.

6.2 Natural Environment

This key criterion mainly addresses the potential impact the preliminary landfill expansion alternatives may have on the surrounding natural environment. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Distance to Terrestrial Habitat;
- Distance to Aquatic Habitat;
- Distance to Species at Risk; and,
- Hydrogeological Conditions (i.e. Overall Condition of Site Setting).

Distance to Terrestrial Habitat

Development of a new site may be limited or prevented due to its proximity to certain land use designations; however, there are no specific regulatory requirements or municipal by-laws that outline setbacks from natural areas.

However, in order to avoid potential interference the distance to the nearest wetland (swamp, bog, marsh, and fen) and the distance to the nearest potentially significant terrestrial habitat (e.g., old growth forest) will be used as ranking criteria to evaluate the feasibility of preliminary landfill expansion alternatives.

Distance to Aquatic Habitat

Aquatic habitat includes lakes, rivers or other water bodies. Section 13 of O. Reg. 347 requires that landfill sites be at least 100 feet (30 m) from any watercourse, lake or pond. In addition, the Municipal Bylaws place further restrictions on land use in EP zones, including agricultural, rural areas, hazard land and sensitive areas (as described previously in Section 6.1). As a result, the distance to the nearest aquatic habitat will be used to evaluate each preliminary landfill expansion alternative.

Distance to Species at Risk

Section 14 of the Township of Dymond By-law No. 1041 requires that landfills must not be located in Environmental Protection (EP) zones. There are no regulatory requirements or by-laws for setbacks from Areas of Natural or Scientific Interest (ANSI).

The development of new landfills may be limited due to proximity to species at risk or their potential habitat through the Natural Heritage Information Centre (NHIC). The NHIC compiles, maintains and distributes information on natural species, plant communities and spaces of conservation concern in Ontario. This information is stored in a spatial database used for tracking this information. The Centre also has a library with conservation-related literature,

reports, books, and maps, which are accessible for conservation applications, land use planning, and natural resource management.

The NHIC web-site can be accesses at http://nhic.mnr.gov.on.ca/MNR/nhic/nhic_.cfm. Natural heritage information can be checked directly on-line using an interactive map or database information can be downloaded in GIS file format. Distance to nearest known or potential species at risk or its critical habitat will be used as criteria to evaluate the feasibility of each preliminary landfill expansion alternative.

Hydrogeological Conditions

The environmental impact of a newly established landfill is dependent on the hydrogeological condition of the landfill property. O. Reg. 347 requires that a landfill shall be at least 100 feet (30 m) from any watercourse, lake or pond. The preliminary landfill expansion alternatives will be ranked and evaluated based on distance to the nearest surface water feature.

Although regulations and by-laws do not specifically address the overall hydrogeological condition of the landfill property, for the purposes of this report the preliminary landfill expansion alternatives will be ranked based on the hydrogeological condition of each site. The ranking will be based on factors such as the presence of a groundwater recharge area near the Site, the degree of existing groundwater contamination, the presence of a significant confining layer, and the number of and distance to potentially impacted aquifers.

6.3 Technical Considerations

This key criterion addresses recommended technical features of each preliminary landfill expansion alternative. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Site Size;
- Leachate Management Strategy;
- Surface Water Management Strategy; and
- Landfill Gas Management Strategy.

Site Size

The first technical consideration that must be evaluated for each preliminary landfill expansion alternative is the size of the proposed landfill, and how it relates to the effort required to implement (i.e., construct) the alternative. As discussed in Section 2.4, this study is to evaluate the feasibility of each preliminary landfill expansion alternative to address the City's long term waste management requirements. It is anticipated that the City will generate approximately 699,073 m^3 of solid waste over a 30-year planning. For the purpose of this study, it is assumed that the Haileybury Landfill Site will continue to be used until it reaches approved capacity (150,953 m^3 of waste to be consumed by 2016, while a new site receives regulatory approvals, permits and is constructed) and the balance of the estimated 30-year planning period waste volume will be disposed of in a newly developed landfill site (approximately 548,120 m^3 of solid waste). As a result, each preliminary landfill expansion alternative will be assessed to ensure

that it can satisfy the required landfill capacity requirements while meeting the MOE design criteria for buffer areas, side slopes, top elevation and regulatory setbacks (as described earlier). Each alternative will also be assessed on the size of the footprint of the potential development, as that is a key indicator of the required construction effort.

Leachate Management

Both of the existing landfill Sites are currently operated as natural attenuation type facilities. To date, the primary control for minimizing leachate impacts to groundwater is the establishment of a CAZ downgradient of each landfill to protect potential receptors. Although natural attenuation will be considered as the primary leachate management strategy for each conceptual landfill expansion alternative, the condition of the existing landfill property, as it relates to site setting factors may require alternative methods for leachate management.

As a result, the feasibility of each conceptual preliminary landfill expansion alternative will be evaluated and ranked based on the leachate management strategy. The assessment will consider factors such as the size, complexity and effort required to implement the leachate management strategy.

Surface Water Management

Typically perimeter drainage systems direct surface water runoff falling on the lands surrounding landfill away from the active tipping face, thus limiting impacts to nearby creeks and surface water bodies. Surface water runoff from within the landfill footprint is managed through the grading of landfill side slopes and top plateaus, and the application of interim cover on inactive landfill areas, and final cover on closed landfill areas. The feasibility of the conceptual landfill development alternatives will be evaluated against the size and complexity of any surface water management features, including length of ditching, number of stormwater ponds, treatment requirements, and water course alteration requirements.

Landfill Gas Management

Landfill gas (LFG) is generated by methanogenic bacteria during decomposition of organic material under anaerobic conditions. The rate of LFG production in a landfill depends on the interrelationship of many factors. The principal factors include waste composition and age, temperature, moisture content, pH, and quantity and quality of available nutrients and microbial populations. The length of time that a landfill may generate LFG can be in excess of 50 years.

Landfill gas is composed of a variety of chemical compounds, which reflects the types of waste that are placed at the landfill site. In general, landfill gas is composed of approximately 50% to 55% methane by volume, 40% to 45% carbon dioxide by volume, and less than 1% other gases such as sulphur species and volatile organic compounds. The concerns with LFG are that the methane gas creates an explosive hazard under certain conditions (between 5% to 15% by volume in air); that LFG will reduce or replace the percentage of the natural atmosphere in enclosed structures, thus creating an oxygen deficient environment; and that there is a potential for health effects depending on the trace gas compounds and levels.

The generated LFG can migrate from a landfill site in two ways. These two methods are emission of the LFG to the atmosphere either under controlled released conditions (designed venting and/or collection structures) or uncontrolled conditions (venting through the landfill cover), and/or the migration of the LFG within the surrounding subsurface until a venting location is encountered.

Gas migration in the subsurface soil is governed by the same general principles as water flow. The subsurface migration of landfill gas is dependent on soil conditions at the landfill site, the landfill gas generation rate, the landfill site design and weather conditions throughout the year. Potential migration of landfill gas will be greatest in the higher permeable soil stratigraphic units that are present around the landfill site. The landfill gas generation rate will govern the amount of gas available to migrate and impact the extent of landfill gas migration, since landfill gas will usually rise. A perched water table or frost layer will influence the distance of landfill gas migration, since the boundary layer will create a reduced exfiltration area for the gas and create the conditions for potential lateral migration.

In June 2008, the Ministry of Environment amended O. Reg. 347 and O.Reg. 232/98 to present requirements for landfill gas collection and management for new, expanding and operating landfills. The amendments are presented in the MOE's Landfill Gas Guideline, which states systems to control the atmospheric emission of landfill gas are required for landfills with capacities larger than 1.5 million cubic meters.

The preliminary design of each landfill expansion alternative will be evaluated and ranked based on whether the proposed expansion will increase the overall landfill capacity to over 1.5 million cubic meters, which will require the establishment of a landfill gas collection and management system.

6.4 Preliminary Capital Cost Estimates

This key criterion addresses projected capital cost of each preliminary landfill expansion alternative. The alternatives will be ranked based on the assessment of the preliminary capital cost estimates presented in Sections 5.2.9 and 5.4.1. Lower cost estimates will be ranked as the most feasible while the higher cost will be ranked as least feasible.

It should be noted that the cost estimates provided in this report are preliminary, based on the preliminary design parameters and basis provided for each landfill expansion alternative. The costs presented herein are intended to provide an order of magnitude estimate for the purposes of a feasibility assessment. They are not intended to be used for budgetary purposes. It is recommended that after the selection and regulatory approval of a preferred long-term landfill disposal strategy, that the City commission a detailed design, upon which one can provide cost estimates suitable for capital budget projections.

7.0 EVALUATION OF CONCEPTUAL DESIGN ALTERNATIVES

7.1 Assignment of Ranking Scores

The ranking of each feasibility assessment criteria will be based on the level of concern and/or the potential for adverse impact presented by each preliminary landfill alternative. The determination of the level of concern and potential for adverse impact will be based on how each alternative affects the criteria's indicator. For example, evaluating a conceptual landfill alternative under the criteria for Public Health, Safety and Socioeconomic Factors will include determining the distance of the proposed landfill expansion to the nearest residence. For the purposes of this feasibility assessment the closer the distance between the proposed expansion and the nearest residence, the greater the level of concern and/or potential adverse impact to the environment.

The rating of the level of concern and/or potential for adverse environmental effects was determined in consultation with City's Technical Advisory Committee. For those criteria where a concern or potential for environmental effect was identified, one of the following ratings was assigned:

- **High** – Where the expansion may affect the environmental component so as to seriously disturb the integrity, distribution, operation, or abundance of the component and is expected to raise serious concern with government reviewers and / or the public.

- **Medium** - Where the expansion may affect the environmental component so as to bring about a disturbance but does not threaten the integrity, distribution, operation, or abundance of the component as determined by government reviewers and the public. Short-term effects associated with construction and operation of facilities also constitute a potential for moderate effects/concerns.

- **Low** – Where the expansion may affect the environmental component in such a way that only a portion of the component is disturbed for a short period of time.

- **None** – The expansion causes little or no affect to the environmental component and causes no concern among government reviewers and/or the public.

To assist with the identification of the overall most feasible (preferred) alternative the following ranking system was applied:

Level of Concern/Potential Impact Rating	Ranking Value
None	0
Low	1
Low to medium	2
Medium	3
Medium to high	4
High	5

The scores are introduced to summarize the quantitative and qualitative evaluation using the individual feasibility assessment sub-criteria and indicators into a numeric score. To arrive at an overall score for each of the preliminary landfill expansion alternative, the individual scores for each sub-criterion will be tallied in order to asses the overall feasibility.

The following sections will present discussions on how each preliminary landfill expansion alternative is assessed for each individual feasibility assessment sub-criteria, as well as summary rankings for the main key criteria.

7.2 Public Health, Safety and Socioeconomic Factors

7.2.1 Residential Areas

During the September 2009 and January 2010 landfill inspections, AMEC observed two residences located within a 400 m radius of the New Liskeard Landfill and no residences located within a 400 m radius around the Harley Township Landfill. Although there are no residences within 400 m of the Harley Township Landfill, there are two residences located within a 1 km radius of the alternative.

As stated in Section 5.1, O. Reg. 347 requires that a landfill be placed at least 400 m from an existing residence, therefore the locations of the residences at the New Liskeard Landfill present a potential conflict with the applicable regulation. However, it should be noted that AMEC is unaware of any complaints issued by the nearby property owners with respect to landfill operations. Additionally, no residences, buildings or structures (other than the landfill operations buildings) are constructed within 30 m of the perimeter of either of the landfill properties, thus the existing New Liskeard Landfill and Harley Township Landfill satisfy the requirements of O. Reg. 232/989 and various City by-laws.

The preliminary landfill expansion alternative for the New Liskeard Landfill involves constructing waste disposal cells on the east side of the existing landfill. Although the environmental impact is low, AMEC observed that due to the location of the existing landfill on the high point of the limestone escarpment, the east side of the existing landfill is visible to the population of the

Town of New Liskeard. Any landfill operations conducted on the east side of the existing landfill will have a visual impact to the local community. The Harley Township Landfill is surrounded on all sides by wooded areas and is located in a more remote area, therefore, it is not visible to the general public.

As such the preliminary landfill expansion alternative for the New Liskeard Landfill will be ranked with a rating of 3 – medium, while the Harley Township Landfill expansion alternative will be ranked with a 2 – low to medium.

Table 15 presents a summary of the ranking and scores with respect to the Residential Areas sub-criterion.

7.2.2 Sensitive Land Uses

As discussed in Section 3.3, there are two residences located within a 400 m radius of the New Liskeard Landfill and two residences located within a 1 km radius of the Harley Township Landfill. The New Liskeard Landfill is located adjacent to agricultural properties, although no Environmental Protection (EP) Zones, Hazard Zones or Sensitive Areas are located within 500 m of the New Liskeard Landfill. The Harley Township Landfill has no agricultural properties, Environmental Protection (EP) Zones, Hazard Zones or Sensitive Areas located within 500 m.

Based on the above noted information the preliminary landfill expansion alternative for the New Liskeard Landfill will be ranked with a level of concern/potential impact rating of 3 – medium to address potential impacts to the residences within a 400 m radius while the preliminary landfill expansion alternative for the Harley Township Landfill will be ranked with a rating of 2-low to medium, to address the potential impacts to the residences within a 1 km radius.

Table 15 presents a summary of the ranking and scores with respect to the Sensitive Land Use sub-criterion.

7.2.3 Drinking Water

As discussed in the Existing Sites Report, there are five (5) drinking water wells within a 500 m radius of the New Liskeard Landfill property. Based on a review of the historical annual water quality monitoring reports for the New Liskeard Landfill, it appears that these wells are either upgradient or crossgradient of the predominant groundwater flow direction indicating low potential impacts by any landfill-derived leachate plume. In addition, there are a number of private water supply wells along Highway 65, approximately 900 m downgradient of the New Liskeard Landfill located east of the established CAZ. As discussed in Section 3.8, the historical water quality monitoring of these wells indicated that these wells were not impacted by leachate.

Although the presence of drinking water supply wells are not anticipated to present a significant constraint to the construction of an expansion of New Liskeard Landfill, further study is

recommended to verify the locations of the nearby water supply wells, as well as to confirm that there are no impacts to the inventoried water supply wells.

There are no drinking water wells located within a 500 m radius of the Harley Township Landfill.

As such, the preliminary landfill expansion alternative for the New Liskeard Landfill will be ranked with a level of concern/potential impact rating of 2 – low to medium while the preliminary landfill expansion alternative for the Harley Township Landfill will be ranked with a rating of 0 – none.

Table 15 presents a summary of the ranking and scores with respect to the Drinking Water sub-criterion.

7.2.4 Accessibility and Driving Distance

The New Liskeard Landfill is located approximately 3 km from the Town of New Liskeard and 9 km from Town of Haileybury, the two main areas of waste generation within the City. The Harley Township Landfill is located approximately 10 km north of the Town of New Liskeard and 18 km north of the Town of Haileybury, although the majority of the route is along the Highway 11 corridor. Both the New Liskeard Landfill and Harley Township Landfill are readily accessed by county roads. As such, the preliminary landfill expansion at the closer New Liskeard Landfill will be ranked with a level of concern/potential impact rating of 0 – none, while the Harley Township Landfill expansion will be ranked with a 2 – low to medium.

Table 15 presents a summary of the ranking and scores with respect to the Accessibility and Driving Distance sub-criterion.

7.3 Natural Environment

7.3.1 Terrestrial Habitat

During the September 2009 and January 2010 landfill inspections, AMEC observed that there were no indicators of a significant terrestrial habitat (i.e. wetlands, old growth forest) in the vicinity of the New Liskeard Landfill or Harley Township Landfill properties. This observation was confirmed during the Site Constraint/Opportunity GIS Mapping, as no significant terrestrial habitats were located within the vicinity of these two landfills. As such, the preliminary landfill expansion at both landfills will be ranked with a level of concern/potential impact rating of 0 – none.

Table 15 presents a summary of the ranking and scores with respect to the Terrestrial Habitat sub-criterion.

7.3.2 Aquatic Habitat

Field observations recorded during the September 2009 and January 2010 landfill inspections did not identify any indicators of aquatic habitats located within the vicinity of the New Liskeard or Harley Township Landfill properties. These observations were confirmed during the performance of Site Constraint/Opportunity GIS Mapping. As such, both preliminary landfill expansion alternatives will be ranked with a level of concern/potential impact rating of 0-none.

Table 15 presents a summary of the ranking and scores with respect to the Aquatic Habitat sub-criterion.

7.3.3 Species at Risk

Field observations recorded during the September 2009 and January 2010 landfill inspections indicate that the lands surrounding the New Liskeard and Harley Landfills are surrounded by natural mixed forests containing flora and fauna species commonly found in northern Ontario. Site Constraint/Opportunity GIS Mapping did not identify any indicators of species at risk (SAR) or Areas of Natural or Scientific Interest (ANSI) located within the vicinity of either landfill. As such, both preliminary landfill expansion alternatives will be ranked with a level of concern/potential impact rating of 0-none.

Table 15 presents a summary of the ranking and scores with respect to the Species at Risk sub-criterion.

7.3.4 Hydrogeological Conditions

Assessments of the hydrogeological condition of the New Liskeard Landfill and the Harley Township Landfill are presented in Sections 3.5 and 4.5, respectively. The primary management strategy for leachate management for each preliminary landfill expansion alternative would be natural attenuation in the subsurface within the CAZ downgradient of the limit of waste.

The New Liskeard Landfill is located in a groundwater recharge area, based on the downward hydraulic gradients reported in the nested wells close to the landfill site, as well as, the location of the site on a topographically elevated, exposed (i.e., little to no overburden) limestone, bedrock ridge. In addition, a number of documented fault zones are present in the vicinity of the site and within the downgradient area. Geological investigations in this area indicate a presence of some overburden to the east of the landfill limits, with depths ranging from 0 to 2 m below ground surface. The absence of a significant low permeability confirming layer overlying the bedrock means that there is a high susceptibility to contaminant migration to the bedrock aquifer and the faults. Historical monitoring results indicate that there is a leachate-impacted groundwater plume, indicated by impacts to monitoring wells located approximately 300 to 350 m downgradient of the landfill. As previously discussed, these impacts are managed though the establishment of a leachate CAZ located immediately downgradient to the east of the landfill property boundary.

Assessing the hydrogeological impact of Conceptual Landfill Development at the Harley Township Landfill is difficult due to the limited historical data of groundwater conditions in the areas of interest. As discussed in Section 4.5, this alternative is located near the top of a bedrock ridge and groundwater divide and is likely a groundwater recharge zone, similar to the New Liskeard Landfill site. Groundwater is expected to flow to the northeast. In contrast to the New Liskeard Landfill site, the Harley Township Landfill alternative may have significantly thicker overburden deposits, which comprise finer grained materials (clays and silts) with a lower permeability that might provide a greater degree of protection to the underlying aquifers. Although it should be noted that the Harley Township Site does not currently have an established CAZ to address leachate management.

Based on the available information, the preliminary landfill expansion alternatives for both the New Liskeard and Harley Township Landfills will be ranked with a level of concern/potential impact rating of 3-medium.

Table 15 presents a summary of the ranking and scores with respect to the Hydrogeological Conditions sub-criterion.

7.4 Technical Considerations

7.4.1 Site Size

Figure 3 presents the proposed conceptual landfill expansion schematic for the Harley Township Landfill while the preliminary design of the proposed landfill expansion for the New Liskeard Landfill is presents on Figures 4 and 5. As discussed in Section 5, the design bases for each alternative differs, as such it is difficult to establish a basis of comparison. Yet, it must be noted that each landfill expansion alternative was developed to ensure that the proposed expansions would be able to fit within the existing limits of the representative landfill property boundary. As such both landfill expansion alternative are ranked with a 1 – low.

Table 15 presents a summary of the ranking and scores with respect to the Site Size sub-criterion.

7.4.2 Leachate Management

Leachate management at the existing New Liskeard Landfill is currently completed through natural attenuation processes within the established CAZ. As discussed in Section 5.2.6, leachate management for the proposed landfill expansion will also be accomplished though natural attenuation for the expanded landfill, thus requiring an expansion of the existing CAZ by 2 ha to 4 ha to the north. As such, this alternative will be ranked with a level of concern/potential impact rating of 1 – low.

Given the current lack of hydrogeological data to support the calculation of a site-specific CAZ for the Harley Landfill, the evaluation was based on a generic CAZ sizing formula, the resultant land area and whether the CAZ would intersect typical groundwater receptors (i.e. other uses or

groundwater discharge zones such as lakes, streams, rivers and wetlands). The required area for the CAZ is approximately 148 ha, including the landfill property and adjacent land extending 1.5 km downgradient of the Harley Landfill. The generic CAZ is presented on Figure 3. Given the greater size of the CAZ required for the Harley Township Landfill and the potential complications associated with the acquisition of 148 ha of CAZ area, this expansion alternative will be ranked with a level of concern/potential impact rating of 3 – medium.

Table 15 presents a summary of the ranking and scores with respect to the Leachate Management sub-criterion.

7.4.3 Surface Water Management

The proposed preliminary landfill expansion alternatives will include the use of perimeter drainage systems and best management practices as primary components of the surface water management system. Although the extent of the proposed perimeter drainage systems is dependent on the overall configuration of the landfill expansion, it is anticipated that the required ditching will be relatively minor and will have minimal overall impact to the environment. As such, both alternatives will be ranked with a level of concern/potential impact rating of 1-low.

Table 15 presents a summary of the ranking and scores with respect to the Surface Water Management sub-criterion.

7.4.4 Landfill Gas Management

As discussed in Section 5.2.8, MOE amended O. Reg. 347 and O.Reg. 232/98 to require that landfill gas management systems be installed for landfills with capacities larger than 1.5 million cubic meters. The Total Site Capacity of the New Liskeard Landfill, including the proposed landfill expansion in less than the 1.5 million cubic meter threshold, as such, for the purposes of this report, it is assumed that landfill gas collection or management systems will not be required. As such, this alternative will be ranked with a level of concern/potential impact rating of 0-none.

The present volume of the existing Harley Township Landfill is currently not known, although it is anticipated that the total site capacity of the landfill including the proposed expansion quantities would be below the 1.5 million cubic meter threshold. For the purposes of that report the expansion alternative at that site was ranked with a level of concern/potential impact rating of 2 – medium to low. That ranking will be maintained for the purposes of this report.

Table 15 presents a summary of the ranking and scores with respect to the Landfill Gas Management sub-criterion.

7.5 Preliminary Capital Cost Estimates

The projected low end and high end present value capital construction cost estimates for the New Liskeard Landfill's preliminary landfill expansion alternative is presented on Tables 8 and 10, respectively. Based on these cost estimates, it is anticipated that the construction of the proposed landfill expansion will range in cost between $3,962,000 and $8,356,000 over the 30-year planning period based on 2010 $CAD.

The projected low end and high end present value capital cost estimates for the Harley Township Landfill's preliminary landfill expansion alternative is presented on Tables 12 and 14, respectively. Based on these cost estimates, it is anticipated that the disposal of wastes at this site will cost the City between $10,139,000 and $14,220,000 over the 30-year planning period based on 2010 $CAD.

As such the preliminary landfill expansion alternative at the New Liskeard Landfill will be ranked with a level of concern/potential impact rating of 2 – low to medium, while the Harley Township alternative will be ranked at a 5 – high.

Table 15 presents a summary of the ranking and scores with respect to the Preliminary Capital Cost Estimate criterion.

7.6 Evaluation and Ranking

Table 15 presents the detailed ranking of each criteria to assess the overall feasibility of the Conceptual Landfill Alternatives. The ranking for each sub-criterion was tallied in order to calculate the score for each feasibility assessment criteria. The score for each criterion was then totalled in order to calculate the overall score for each preliminary landfill expansion alternative. A summary of the feasibility assessment scores is presented below:

Feasibility Assessment Criteria	New Liskeard Landfill	Harley Township Landfill
Public Health, Safety and Socioeconomic Factors	8	6
Natural Environment	3	3
Conceptual Technical Considerations	3	6
Preliminary Capital Cost Estimates	2	5
TOTAL	**16**	**20**

8.0 PREFERRED LONG-TERM LANDFILL DISPOSAL STRATEGY

Based on the results of the discussion and ranking provided above in Section 7.0 and on Table 15 the preliminary landfill expansion alternative for the existing New Liskeard Landfill is the preferred long-term landfill disposal strategy for the City of Temiskaming Shores. This alternative includes the following features:

- Buffer Zone Size = Minimum 30 m between the limit of waste and landfill property boundary on all sides;
- Base Elevation Range = 244 to 258 masl;
- Top Elevation = 280.0 masl;
- Final Cover Slopes = 20:1 (Min.) to 4:1 (Max.)
- Landfill waste quantity = 707,000 m^3;
- Landfill daily cover soil quantity = 177,000 m^3;
- 600 mm thick clay initial cover layer quantity = 57,000 m^3; and
- 150 mm thick vegetated topsoil quantity = 14,000 m^3.
- Leachate Management Strategy = Natural Attenuation
- Required Extension of established CAZ = 2 ha to 4 ha to the north;
- Surface Water Management Strategy = approximately 500 linear meter of perimeter ditching;
- Landfill Gas Management Strategy = not required and,
- Preliminary Capital Cost Estimate Range = $3,962,000 and $8,356,000

The solid waste management strategy proposed herein includes the continued operation Haileybury Landfill through 2016 until the landfill has reached its proposed final contours and has achieved its approved Total Site Capacity of 452,221 m^3. Once the Haileybury Landfill is closed, the City can subsequently implement its preferred long-term landfill disposal strategy.

9.0 LANDFILL EXPANSION APPROVAL PROCESS

Section 8 presents a summary of the preliminary design parameters and preliminary capital construction costs prepared for the preferred landfill expansion alternative at the New Liskeard Landfill. The preliminary design and preliminary capital cost estimate were prepared based on currently available technical data, and was provided for the purposes of assessing the feasibility of implementing the preferred alternative. Section 9.0 presents a discussion on the recommended "next steps" for the City to obtain regulatory approval of the preferred landfill expansion alternative under the Environmental Assessment Act and the Environmental Protection Act. The regulatory approvals process involves performing additional intrusive site investigations in order to supplement and augment the available technical data, and to provide a basis for more detailed designs of the proposed landfill expansion and more detailed capital cost budget projections.

9.1 Approval under the Environmental Assessment Act

In accordance with Ontario Regulation 101/07 (O.Reg. 101/07) made under the Environmental Assessment Act, any change to a landfill site that increases the site's capacity by more than 100,000 m^3 over its maximum authorized volume, is an undertaking that is subject to an Environmental Assessment (EA) under the Environmental Assessment Act (EA Act). The EA Act specifies the requirements for the EA process. Further guidance is provided in the following documents:

- Code of Practice: Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario (MOE, June 2007); and

- Code of Practice: Preparing and Reviewing Environmental Assessments in Ontario (MOE, November 2008).

To obtain approval under the EA Act, the City is required to submit an EA Report to the MOE for formal review and approval. The Minister may decide to approve the undertaking, to approve the undertaking subject to conditions, or refuse to give approval. In its decision, the Minister takes into account such aspects as the purpose of the EA Act, the EA Report, and comments received from the public.

In accordance with the EA Act, the EA process involves two major activities:

1. Preparation, review and approval of the Terms of Reference for the Environmental Assessment; and

2. Preparation, review and approval of the Environmental Assessment Report.

The following sections outline the key elements associated with each of these two activities.

9.1.1 Terms of Reference

The first main activities outlined for the EA (i.e., planning) process is the preparation, submission, review and approval of a Terms of Reference (TOR). The TOR sets out the framework that will guide the preparation of the EA. The process to establish the TOR provides the public, project stakeholders and other interested parties an early opportunity to acquire information about the proposed project, to get involved in the planning process and to decide on the level of concern and need providing input and for continued participation in the planning process.

The approval of the TOR is the first statutory decision made by the MOE in the EA planning and approvals process. As part of the formal submission/approvals process, a draft TOR is developed and submitted to the MOE for public and governmental agency comment and review. The draft TOR will also outline a study approach consisted with the requirements of the EA Act.

Draft Terms Of Reference

The TOR provides a general description of the undertaking and outlines the proposed approach to the EA process. The draft TOR document will be developed based on the review of background information and available technical data for the project site. In general the draft TOR will provide information on the following:

- Identification of the proponent (being the City of Temiskaming Shores);
- Approach to the EA process;
- Purpose of the study and undertaking;
- Description and rationale for the undertaking;
- Description and rational for any “Alternatives To” or “Alternative Methods” for the undertaking;
- Description of the existing environment in relation to the project site;
- Potential socioeconomic, environmental and technical effects of the undertaking;
- Approach to the assessment and evaluation of the potential effects;
- Commitments to impact management and monitoring;
- Public Consultation Plan; and
- Requirements for other regulatory approvals.

An essential aspect of the EA process is the “high-level” consideration of “Alternatives To” and/or “Alternative Methods” to the proposed undertaking. The TOR therefore outlines the City’s intent on how to approach this subject. This includes the range of alternatives to be considered, criteria for the evaluation, and the decision making process that will be followed to justify the selection of the preferred alternative Consideration of alternatives at the TOR stage provides for a more focused EA process which will help to streamline the public consultation activities involved in the process.

The involvement of the public is also of critical importance in the EA process. The draft TOR must therefore prescribe how the City will provide opportunities for public and stakeholder involvement during the EA processes. The development of a Public Consultation Plan will also

serve to document the issues and concerns that were raised during the consultation on the draft TOR.

A Public Consultation Plan must be developed and implemented to meet the requirements of the EA Act, as specified in the *Code of Practice for Consultation in Ontario's Environmental Assessment Process* (MOE, June 2007)." This plan typically outlines activities for public involvement and exchange of information by means such as public notices, public meetings, letter mail outs, web-based information portals etc. For consultation on the TOR, these activities will need to be implemented during the TOR development process and documented in a Record of Consultation. Consultation on the EA will be implemented following TOR approval and will be documented in the EA Report.

The provision of adequate consultation on the TOR is particularly important in context of the above outlined focused approach to the EA. The City's draft WMMP and relevant feasibility studies will represent "Supporting Documents" to the TOR and provide the rationale for the focus of the EA process. Since the feasibility studies have not yet been discussed with the general public, these planning steps need to undergo public consultation during the TOR phase.

The draft TOR will be made available to interested parties for review and comment. This is expected to include an internal review by the MOE. Input received will be used to develop a finalized and approved Terms of Reference document, which will be the basis a focused Environmental Assessment.

9.1.2 Baseline Environmental Studies and Descriptions of the Existing Environment

Following TOR approval, the next step of the EA process involved performing baseline environmental studies at the project site to develop a description of the existing environment. In general, it is expected that the existing technical and environmental background information will provide initial information for the EA process. Yet, baseline environmental studies may require additional intrusive site investigations in order to fill in "data gaps" observed in the available background information.

In general, baseline studies will be performed for such areas as:

- Climate, Air Quality (Dust, Odour);
- Noise;
- Geology, Hydrogeology;
- Geotechnical;
- Surface Water (i.e., hydrology);
- Terrestrial Environment (incl. Wetlands);
- Aquatic Environment;
- Socio-Economic Environment (e.g., Land Use, Heritage, Transportation, Employment); and

- Archaeology.

Some study areas (e.g., geology, hydrogeology, geotechnical and surface water) will not only provide additional information will likely need to be collected to generate a comprehensive description of the existing environment for the EA Report, but will also provide a basis for detailed landfill expansion design, engineering and construction.

9.1.3 Development and Evaluation of Alternatives

Similar to the Feasibility Study process, the EA process will need to address "Alternatives To" and "Alternative Methods" for the proposed undertaking. "Alternative To" may include the identification of alternative waste management systems while "Alternative Methods" may address alternative designs for the expansion the New Liskeard Landfill. The evaluation of the alternatives will need to be conducted on the basis of criteria and approaches outlined in the TOR. It should be noted that the feasibility assessments performed for the project may be used as a reference for development and evaluation of alternatives. Once the preferred alternative has been verified and confirmed the EA process will require a detailed description of the undertaking, which includes the development of preliminary design and operations plans.

9.1.4 Effects Assessment, Mitigation and Monitoring Plans

The EA process includes assessing, the potential impacts of all the phases (construction, operation, and closure) of the proposed expansion of the New Liskeard Landfill. This assessment will be based on technical studies and effects predictions that will be prepared for each of the relevant environmental factors. The work is expected to address potential effects on the terrestrial and aquatic environment, surface and groundwater resources, air quality and noise, and socio-economic factors (local community, economy, and infrastructure).

As part of the effects assessment, contingency measures will be developed to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment (mitigation measures). The EA will also need to determine the necessary environmental monitoring programs during project implementation and future operation.

9.1.5 Environmental Assessment Report

In accordance with the EA Act, and EA Report will be developed to provide key information on the following:

- Identification of the proponent (being the City of Temiskaming Shores);
- Description of the purpose of the undertaking;
- Description and rationale for the undertaking and alternatives;
- Potential socioeconomic, environmental and technical effects of the undertaking;
- Mitigation measures and monitoring strategy;
- Advantages/disadvantages of the undertaking and alternatives; and
- Summary of consultation efforts and results.

A draft EA Report will be made available for stakeholder review prior to finalizing and formal submission to the MOE. MOE approval of the proposed undertaking will be represented by approval of the final EA Report.

The EA process typically requires about two years from commencement to the MOE approval. This includes about approximately 6 months for the TOR development approvals process and approximately 16 months for baseline study, public consultation and EA Report preparation/approval. The timeline estimate includes considerable time periods for government and public reviews of draft and final planning documents. It should be noted that depending on the level of public interest and the significance of issues and concerns raised bay stakeholders, the planning process can extend over significantly longer time periods.

9.1.6 Preliminary Cost Estimate for EA Approval

Table 16 presents a summary or low end and high end ranges of costs associated with the regulatory approval under the Environmental Assessment Act. Overall the preliminary costs for EA Act Approval may range from $145,000 to $295,000. These costs are based on AMEC's experience for EA Act approvals and are provided for informational purposes only. Actual costs for EA Act approval of the City's proposed expansion of the New Liskeard Landfill are likely to differ due to project and site specific factors.

9.2 Approval under the Environmental Protection Act

Ontario landfill sites are subject to approval under Part V of the Environmental Protection Act (EP Act). The EP Act includes the basic framework of regulations for waste management sites under O. Reg. 347, but new and expanding landfill sites are subject to approval in accordance with O.Reg. 232/98.

In accordance with the EP Act and O.Reg. 232/98, the approvals process for the proposed expansion to the New Liskeard Landfill will involve the following key activities:

1. Preparation, review and approval of Hydrogeological Assessment;

2. Preparation, review and approval of a Surface Water Assessment; and

3. Preparation, review and approval of a detailed Design and Operations Report.

The following sections briefly outline the key elements associated with each of these activities.

9.2.1 Preparation of a Hydrogeological Assessment Report

Section 8 of O.Reg. 232/98 states that prior to establishing a new landfill site or expanding an existing landfill site, the City must prepare a written report on the geologic and hydrogeologic conditions of the subject property. The regulation indicates that this written report contain the following:

- Plans, specifications and descriptions of the site-specific geologic and hydrogeologic conditions;
- Descriptions of the regional geologic and hydrogeologic conditions;
- A design of the landfill or landfill expansion;
- Descriptions of the existing site features and the features that will be implemented to manage leachate and landfill gas;
- Outlines of groundwater monitoring plans; and
- Outlines of contingency plans that can be implemented to manage and/or control future or extensive leachate/landfill gas impacts.

In the case of the proposed expansion to the New Liskeard Landfill, the hydrogeological assessment can include a review of existing background information and technical data, as well as technical data generated during the baseline environmental studies phase of the EA process. In some cases, additional intrusive site investigations are commissioned as part of the hydrogeological assessment to address possible data gaps in the background/historic documentation or to generated technical data specific to the detailed design of the landfill or landfill expansion.

The overall objectives of the hydrogeological assessment is to determine the following:

- the physical, hydraulic and chemical properties of the surfical and sub-surface soils/aquifers;
- groundwater flow characteristics;
- potential contaminant plume migration pathways;
- structural integrity of the sub-grade and supporting soils;
- availability and suitability of the native soil for cover and liner use;
- establish/augment a groundwater monitoring network; and,
- feasibility of leachate/landfill gas management controls and contingency plans.

In general, the hydrogeological assessment is conducted prior to or concurrent with the preparation of a detailed design and operations plan, which is discussed in Section 9.2.2.

9.2.2 Preparation of a Detailed Design & Operations Plan

Section 6 of O.Reg. 232/98 requires the City prepare a report containing the design, plans, specifications for the proposed landfill expansion at the New Liskeard Landfill to ensure that the design and site operations minimizes impacts to groundwater, surface water, air and the local environment. In general design and operations (D&O) plan contain the following:

- Detailed topographic survey plan of the project sites;

- Detailed designs for the proposed landfill expansion boundaries, buffer areas, waste fill areas, contours, surface water controls, access roads, structures and final cover design;
- Designs of any liner and/or leachate/landfill gas management systems;
- Descriptions of the monitoring facilities for groundwater, leachate and surface water;
- Outlines of site operations and facilities;
- Descriptions of contingency plans for leachate management; and,
- Site closure and post-closure care requirements.

In the case of the proposed expansion to the New Liskeard Landfill, the D&O plan report represents the progression of the preliminary design of the landfill design to a level suitable to facilitate MOE approval of the facility. Approval of the D&O plan is represented by the issuance of a new provisional Certificate of Approval for a Waste Disposal Site or amendment to and existing C of A which incorporates the updated site operations and monitoring strategies.

9.2.3 Environmental Protection Act Approval Process

The EP Act approval process typically requires about one to two years from commencement to the MOE approval. This includes about approximately 6 months to 1 year for the preparation of the hydrogeological assessment and D&O plans and approximately 6 months to 1 year between submission of the reports to the MOE and obtaining MOE approval It should be noted that depending on the finding of the hydrogeological assessment or the complexity of the D&O plan, the planning process can extend over longer time periods.

9.2.4 Preliminary Cost Estimate of EPA Approval

Table 17 presents a summary or low end and high end ranges of costs associated with the regulatory approval under the Environmental Protection Act. Overall the preliminary costs for EP Act Approval may range from $145,000 to $295,000. These costs are based on AMEC's experience for EP Act approvals and are provided for informational purposes only. Actual costs for EP Act approval of the City's proposed expansion of the New Liskeard Landfill are likely to differ due to project and site specific factors.

9.3 Approval Under the Ontario Water Resources Act

Industrial sewage works are defined as any works associated with the collections, transmission, treatment or disposal of wastewater generated from industrial activities. These include works that handle storm runoff such as engineered wetlands, stormwater retention/detention ponds, and leachate collection and treatment systems. Such facilities are often used as surface water management controls at landfill sites, and are subject to regulatory approval under Section 53 of the Ontario Water Resources Act (OWRA).

Due to the minimal historical surface water impacts observed at the New Liskeard Landfill, the surface water management features presented as part of the preliminary design of the proposed landfill expansion include the establishment of perimeter drainage ditches between

the proposed limit of waste and the proposed perimeter access roads, to divert surface water runoff coming onto the site and to control runoff discharging from the site. The preliminary design currently contains no other surface water management feature, but it is recommended that additional hydrological investigations and modelling be conducted as part of the EA process and EPA process to verify the need for industrial stormwater management system for the proposed landfill expansion. Verification and confirmation of the need of further surface water management features will drive the need to undertake a design and approval of the features under the OWRA.

10.0 RECOMMENDATIONS

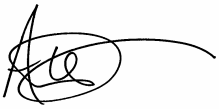
Upon acceptance of the findings this report, it is recommended that the City of Temiskaming Shores expedite the initiation of the process to obtain regulatory approval of the preferred landfill expansion alternative at the New Liskeard Landfill under the Environmental Assessment Act.

11.0 CLOSURE

This report was prepared exclusively for the City of Temiskaming Shores for specific application to the Feasibility of a Long-Term Landfill Disposal Strategy as it relates to the expansion of either the New Liskeard or Harley Township Landfills. The feasibility assessment provided herein was completed in accordance with the verbal and written requests from the City of Temiskaming Shores and generally accepted engineering practices. No other warranty, express or implied, is made.

Respectfully submitted,
AMEC Earth & Environmental,
A Division of AMEC Americas Limited

Prepared By:



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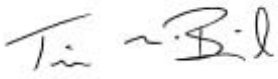

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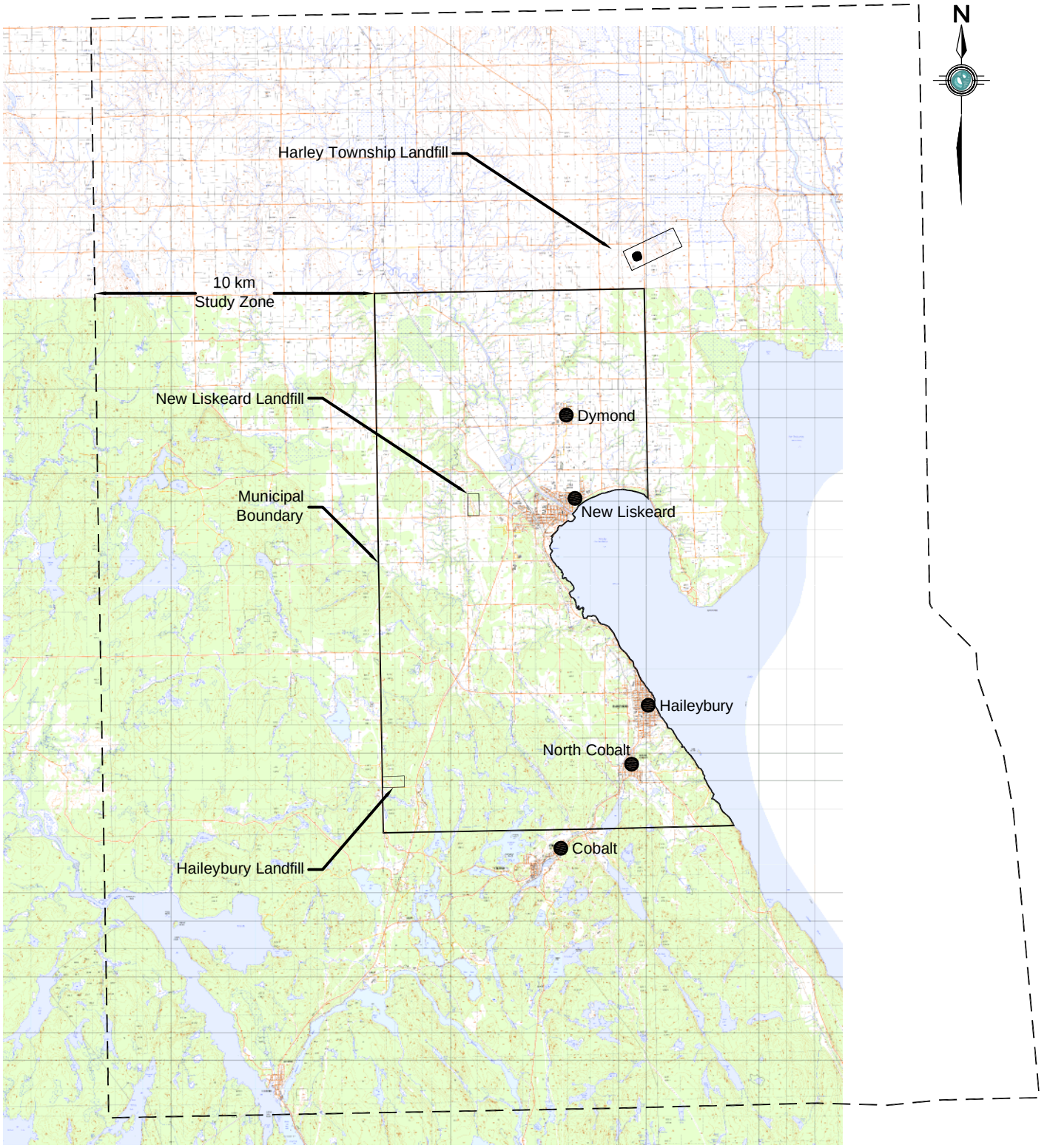

AMEC Earth & Environmental
131 FIELDING ROAD
LIVELY, ONTARIO, CANADA
P3Y 1L7

CLIENT: CITY OF TEMISKAMING SHORES

PROJECT: FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY

TITLE: **SITE LOCATION MAP**

DWN BY:	DATUM:	DATE:
SGC		July 2010
CHK'D BY:	REV. No.:	PROJECT No.:
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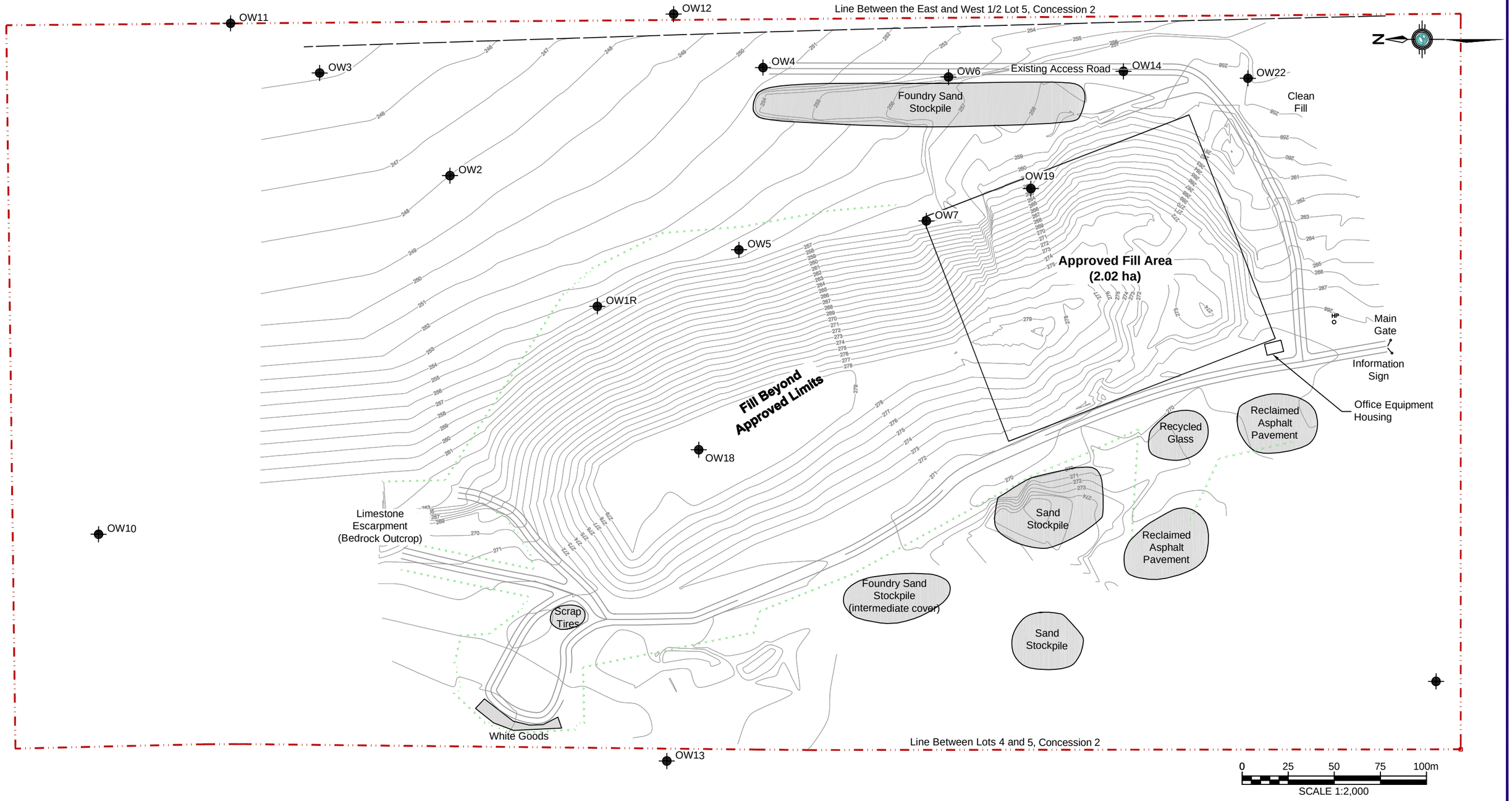

LEGEND:

- PROPERTY BOUNDARY
- FENCE LINE
- 2007 TOPOGRAPHIC CONTOURS
- MONITORING WELLS

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		CHK'D BY: AKW		DATE: June 2010
AMEC Earth & Environmental 131 FIELDING ROAD LIVELY, ONTARIO, CANADA P3Y 1L7		DATUM:	TITLE: NEW LISKEARD LANDFILL SITE PLAN 2007 TOPOGRAPHIC CONTOURS	PROJECT No.: TY91049.8000
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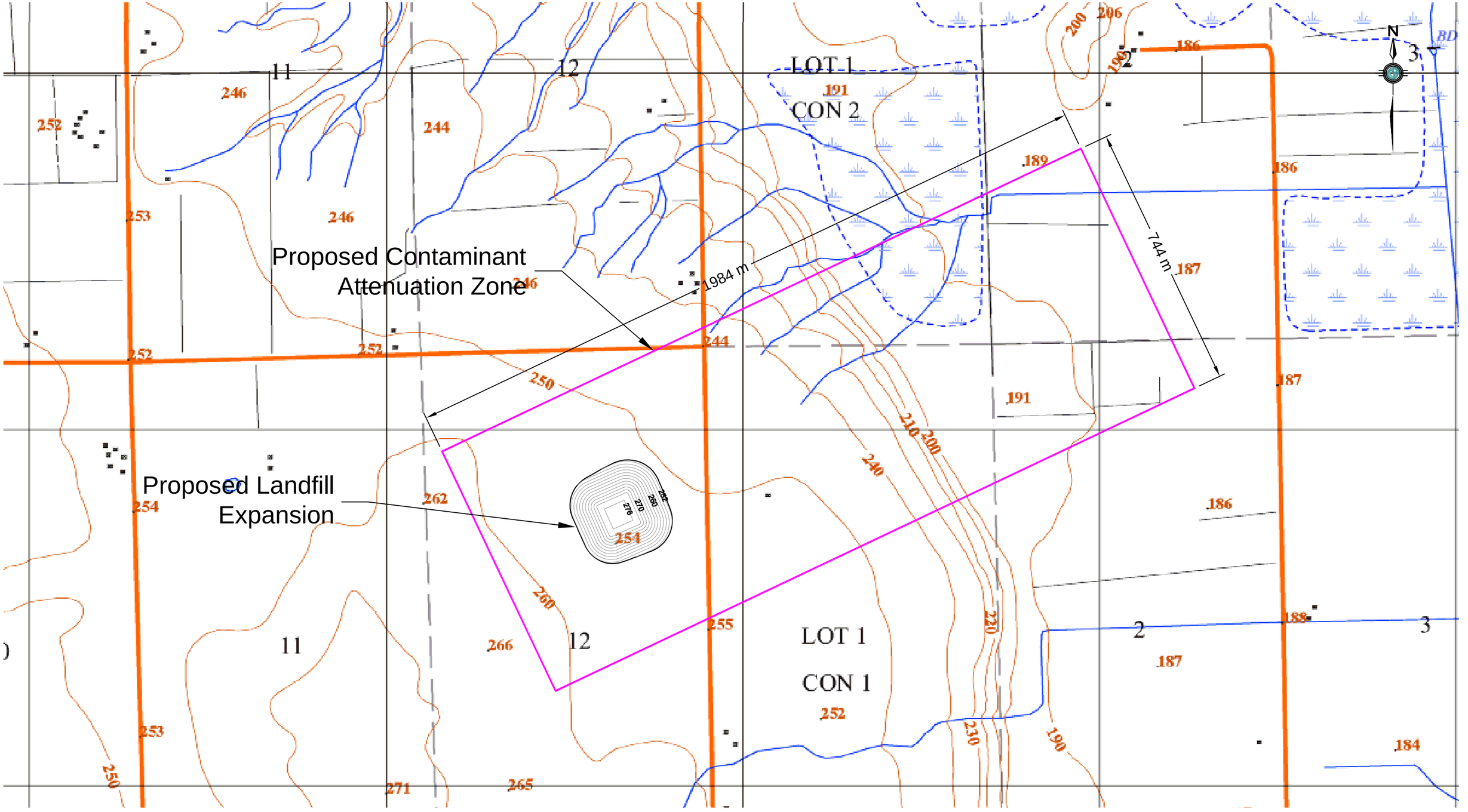

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		CHK'D BY: AKW		DATE: June 2010
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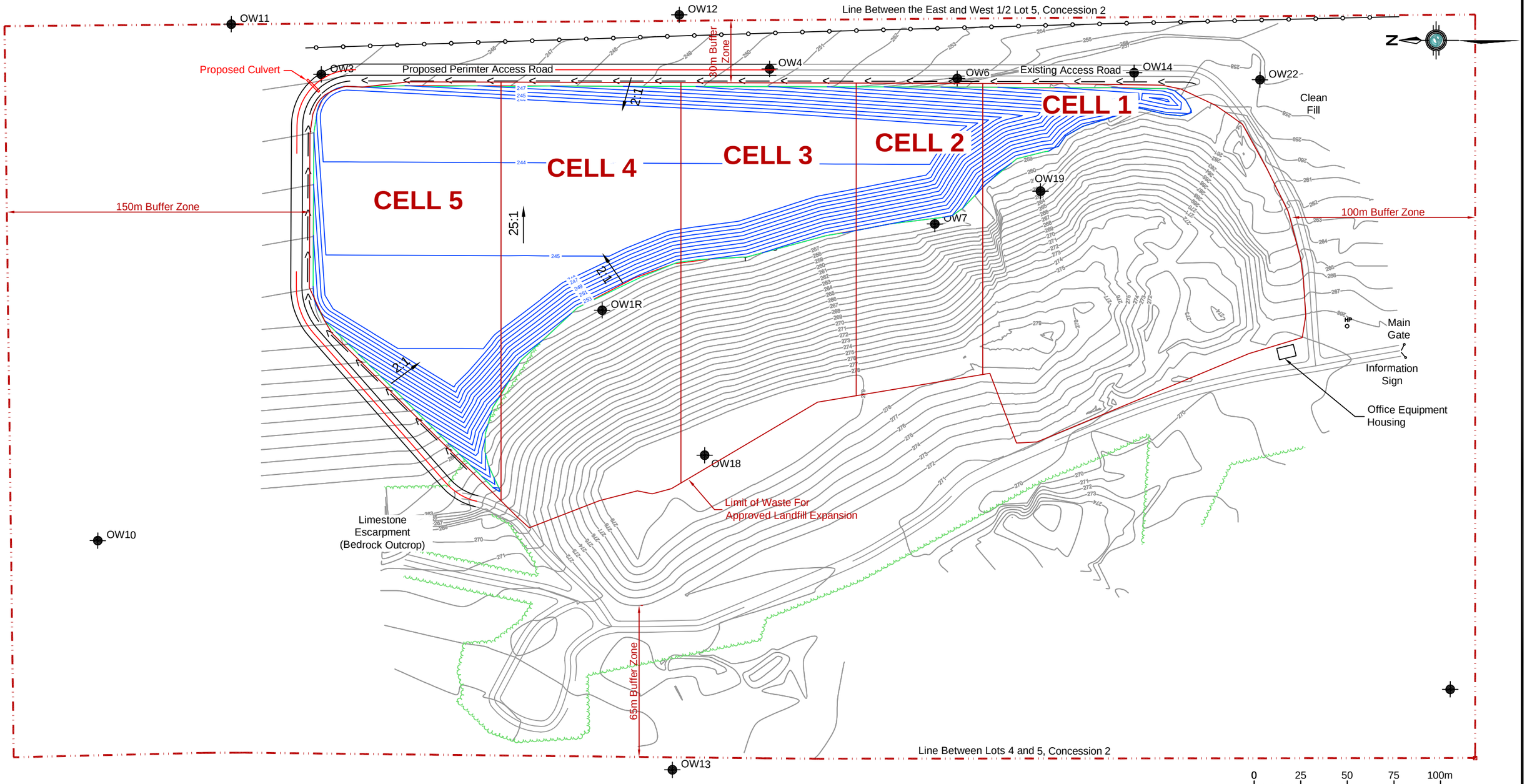

LEGEND:

- PROPERTY BOUNDARY
- FENCE LINE
- 2007 TOPOGRAPHIC CONTOURS
- PROPOSED BASE CONTOURS
- PROPOSED DRAINAGE DITCH
- MONITORING WELLS

CLIENT: CITY OF TEMISKAMING SHORES	DWN BY: SGC	PROJECT: FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY	REV. No.: 1	
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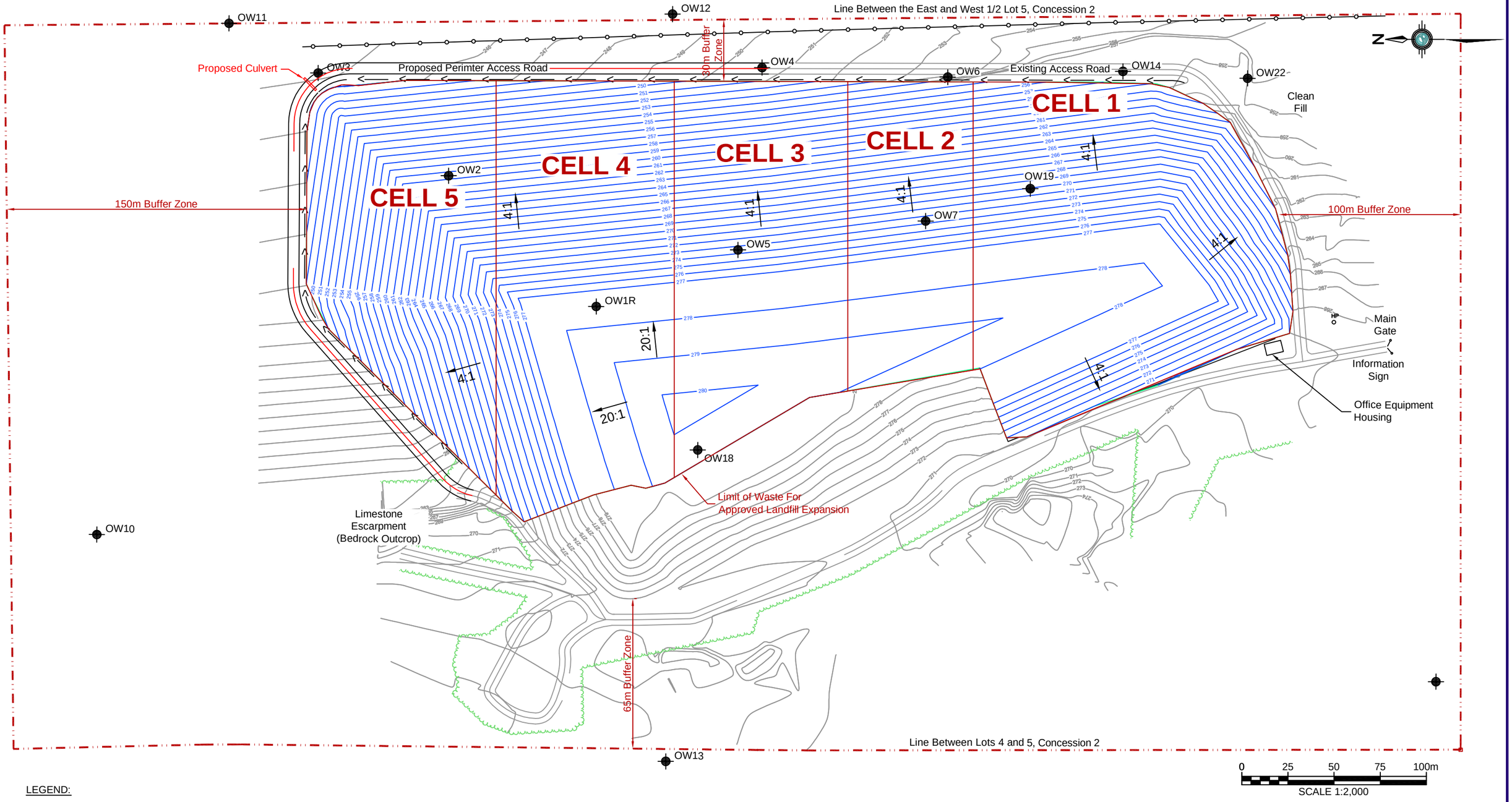

LEGEND:

- PROPERTY BOUNDARY
- FENCE LINE
- 2007 TOPOGRAPHIC CONTOURS
- PROPOSED FINAL CONTOURS
- PROPOSED DRAINAGE DITCH
- MONITORING WELLS

CLIENT: CITY OF TEMISKAMING SHORES	DWN BY: SGC	PROJECT: FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY	REV. No.: 1	
	CHK'D BY: AKW		DATE: June 2010	
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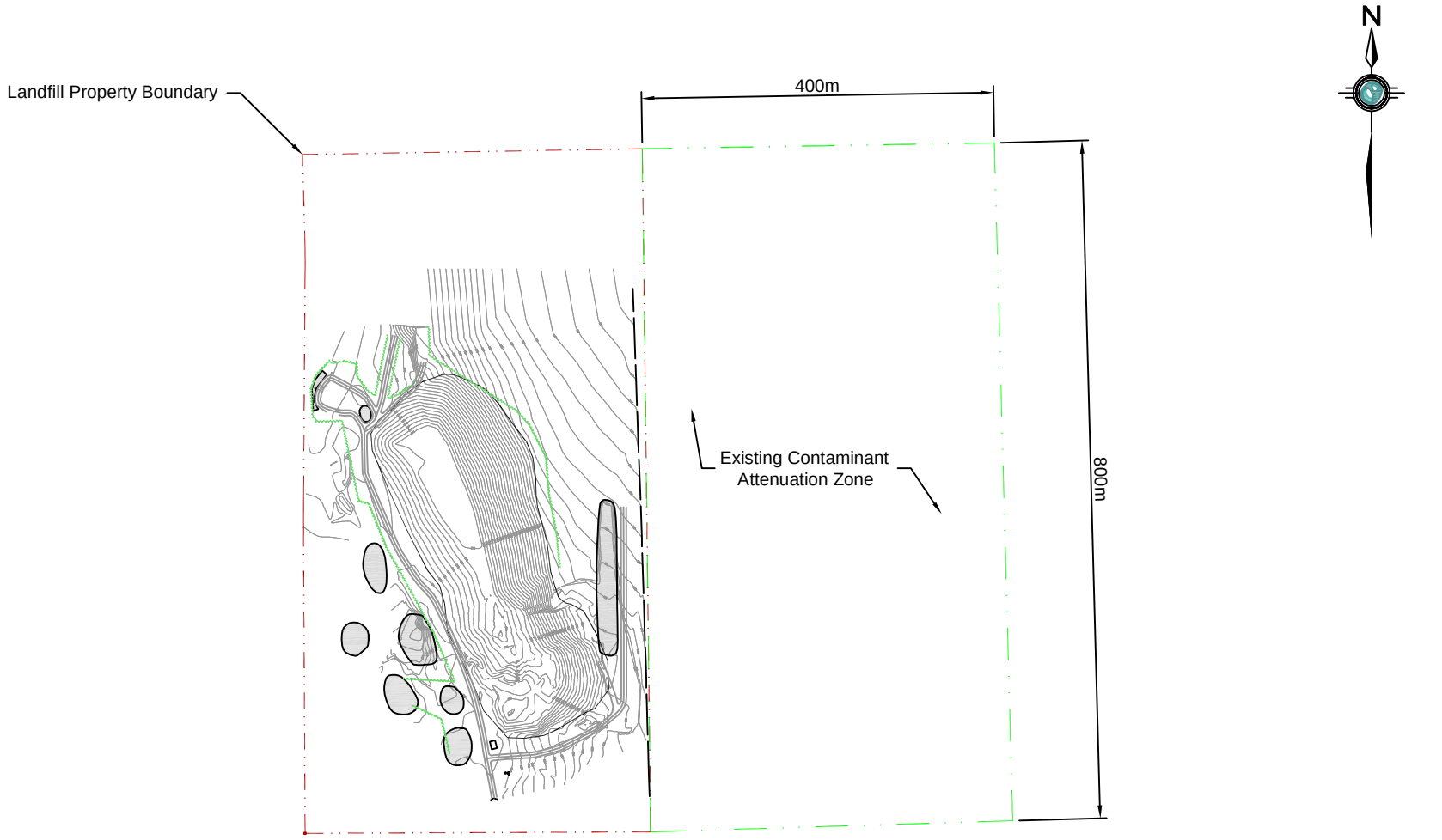

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	CHK'D BY: AKW		DATE: June 2010	
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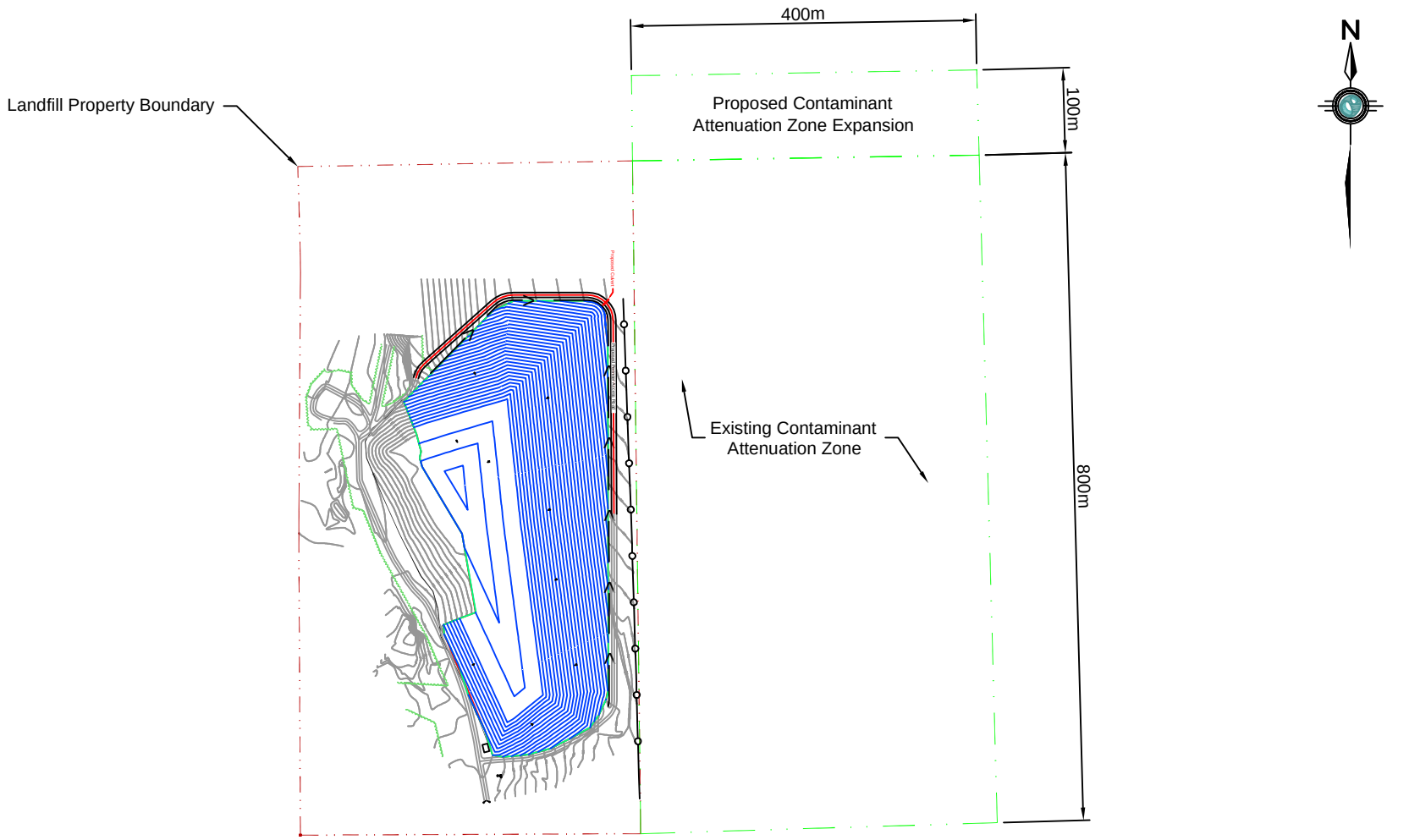

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AMEC Earth & Environmental 131 FIELDING ROAD LIVELY, ONTARIO, CANADA P3Y 1L7	DATUM:	TITLE: NEW LISKEARD LANDFILL EXPANSION PLAN PRELIMINARY DESIGN PROPOSED CONTAMINANT ATTENUATION ZONE EXPANSION	PROJECT No.: TY91049.8000	
	PROJECTION:		FIGURE No.: 7	
	SCALE: 1:7,500			

TABLE 1

WASTE QUANTITIES DEPOSITED AT HAILEYBURY LANDFILL (1997 to 2008[1])
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

MONTH	Volume of Waste from Town of Haileybury (m^3)											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	638	562	459	497	651	776	755	Beginning 2004, waste volumes combined with the City of Temiskaming Shores due to Amalgamation				
FEBRUARY	387	415	445	590	537	782	633					
MARCH	473	493	555	641	657	459	613					
APRIL	834	736	658	594	763	1,753	1,187					
MAY	943	1,096	1,471	789	2,123	2,123	2,198					
JUNE	775	684	755	677	840	1,412	154					
JULY	790	612	616	624	868	861	1,207					
AUGUST	1,326	551	787	971	761	1,507	825					
SEPTEMBER	959	856	680	624	1,111	843	1,000					
OCTOBER	1,068	642	613	989	1,520	1,283	869					
NOVEMBER	543	1,089	474	632	1,610	880	1,211					
DECEMBER	579	668	546	564	815	973	870					
TOTAL	9,315	8,404	8,059	8,192	12,256	13,652	11,522					

MONTH	Volume of Waste from Town of Dymond (m^3)											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	488	389	467	417	507	477	483	Beginning 2004, waste volumes combined with the City of Temiskaming Shores due to Amalgamation				
FEBRUARY	367	363	378	489	450	449	481					
MARCH	475	427	477	526	499	532	488					
APRIL	393	574	435	489	515	530	526					
MAY	766	802	447	521	717	806	1,084					
JUNE	626	469	621	573	493	565	80					
JULY	600	569	539	661	630	495	598					
AUGUST	473	622	499	561	501	542	732					
SEPTEMBER	511	473	514	965	536	465	553					
OCTOBER	543	456	458	517	578	496	535					
NOVEMBER	504	467	496	515	505	520	1,014					
DECEMBER	422	458	548	504	563	1,091	530					
TOTAL	6,168	6,069	5,879	6,738	6,494	6,968	7,104					

MONTH	Volume of Waste from Town of Cobalt (m^3)											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	177	157	150	115	130	119	163	117	117	114	142	134
FEBRUARY	114	121	139	97	113	92	208	117	67	119	119	109
MARCH	113	139	133	121	112	167	125	158	158	15	110	107
APRIL	137	231	176	165	115	138	152	128	146	11	123	331
MAY	195	167	156	118	166	164	177	157	121	15	151	108
JUNE	151	172	154	140	108	143	109	122	117	8	125	112
JULY	168	187	233	138	165	161	157	135	118	602	132	103
AUGUST	166	185	187	118	841	287	151	156	147	164	153	116
SEPTEMBER	158	163	184	332	131	271	135	212	125	112	120	111
OCTOBER	168	192	184	99	104	161	150	258	119	129	162	179
NOVEMBER	118	137	110	97	144	118	119	158	127	131	108	115
DECEMBER	161	125	157	108	130	121	159	115	112	103	107	143
TOTAL	1,826	1,976	1,963	1,648	2,259	1,942	1,805	1,833	1,474	1,523	1,552	1,668

MONTH	Volume of Waste from Towns of Haileybury and Dymond (m^3)											
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
JANUARY	Pre-Amalgamation							1,052	1,066	992	1,057	891
FEBRUARY								1,028	957	1,158	900	667
MARCH								1,187	1,237	942	976	891
APRIL								1,613	1,106	3,194	1,297	1,402
MAY								1,346	1,263	1,168	1,492	3,639
JUNE								1,282	1,108	1,138	1,787	2,002
JULY								1,391	826	2,961	1,517	1,680
AUGUST								1,608	1,002	1,661	3,191	1,206
SEPTEMBER								1,718	888	1,315	1,230	1,476
OCTOBER								1,041	1,448	1,219	906	1,576
NOVEMBER								1,274	3,454	1,651	1,703	952
DECEMBER								1,580	1,347	1,156	609	904
TOTAL								16,120	15,702	18,555	16,665	17,286

TOTAL (m^3)	**17,309**	**16,449**	**15,901**	**16,578**	**21,009**	**22,562**	**20,431**	**17,953**	**17,176**	**20,078**	**18,217**	**18,954**

Notes:

All units are cubic meters

1. Waste volume estimates presented herein were provided by the City of Temiskaming Shores and were recorded by landfill operators prior to disposal and compaction activities.
2. The June 2003 monthly refuse volumes are artificially low since some of the refuse for June was entered for the month of May, hence the higher than normal May monthly refuse volumes.

TABLE 2

SUMMARY OF WASTE QUANTITIES DEPOSITED AT EXISTING LANDFILL SITES (1997 to 2008) FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY CITY OF TEMISKAMING SHORES

Year	New Liskeard Landfill[(1)] (m^3/year)	Haileybury Landfill[(2)] (m^3/year)
1997	NA	17,309
1998	NA	16,449
1999	NA	15,901
2000	16,806	16,578
2001	14,769	21,009
2002	13,844	22,562
2003	11,667	20,431
2004	10,102	17,953
2005	12,032	17,176
2006	18,554	20,078
2007	20,335	18,217
2008	19,456	18,954

Notes:

1. Waste Quantities for New Liskeard Landfill are based on summary provided in Section 5.1.1. of the Draft Solid Waste Management Master Plan (Earth Tech, August 2009).

2. Waste Quantities for Haileybury Landfill were provided by the City of Temiskaming Shores and represent a summary of the quantities outlined on Table 1.

NA - Data not available.

Quantity estimates presented were recorded prior to disposal and compaction by the landfill operators.

TABLE 3

PROJECTED WASTE GENERATION QUANTITIES
OVER 30-YEAR PLANNING PERIOD
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Table 3a: Projected Waste Generation for the Towns of Haileybury, Dymond and Cobalt

Planning Year	Population Growth Estimate[1]	Per Capita Waste Generation Estimate (m^3/capita)	Estimated Volume of Uncompacted Waste Generated (A) (m^3)
2008[2]	7,214	2.6	18,954
2009	7,294	2.6	18,964
2010	7,374	2.6	19,172
2011	7,454	2.6	19,380
2012	7,534	2.6	19,588
2013	7,613	2.6	19,794
2014	7,693	2.6	20,002
2015	7,773	2.6	20,210
2016	7,853	2.6	20,418
2017	7,933	2.6	20,626
2018	8,013	2.6	20,834
2019	8,092	2.6	21,039
2020	8,172	2.6	21,247
2021	8,252	2.6	21,455
2022	8,332	2.6	21,663
2023	8,412	2.6	21,871
2024	8,492	2.6	22,079
2025	8,571	2.6	22,285
2026	8,651	2.6	22,493
2027	8,731	2.6	22,701
2028	8,811	2.6	22,909
2029	8,891	2.6	23,117
2030	8,971	2.6	23,325
2031	9,051	2.6	23,533
2032	9,130	2.6	23,738
2033	9,210	2.6	23,946
2034	9,290	2.6	24,154
2035	9,370	2.6	24,362
2036	9,450	2.6	24,570
2037	9,530	2.6	24,778
2038	9,609	2.6	24,983
2039	9,689	2.6	25,191

Table 3b: Projected Waste Generation for the Town of New Liskeard

Planning Year	Population Growth Estimate[1]	Per Capita Waste Generation Estimate (m^3/capita)	Estimated Volume of Uncompacted Waste Generated (B) (m^3)
2008[2]	5,017	3.9	19,456
2009	5,073	3.9	19,785
2010	5,128	3.9	19,999
2011	5,183	3.9	20,214
2012	5,239	3.9	20,432
2013	5,294	3.9	20,647
2014	5,350	3.9	20,865
2015	5,405	3.9	21,080
2016	5,460	3.9	21,294
2017	5,516	3.9	21,512
2018	5,571	3.9	21,727
2019	5,626	3.9	21,941
2020	5,682	3.9	22,160
2021	5,737	3.9	22,374
2022	5,793	3.9	22,593
2023	5,848	3.9	22,807
2024	5,903	3.9	23,022
2025	5,959	3.9	23,240
2026	6,014	3.9	23,455
2027	6,069	3.9	23,669
2028	6,125	3.9	23,888
2029	6,180	3.9	24,102
2030	6,236	3.9	24,320
2031	6,291	3.9	24,535
2032	6,346	3.9	24,749
2033	6,402	3.9	24,968
2034	6,457	3.9	25,182
2035	6,512	3.9	25,397
2036	6,568	3.9	25,615
2037	6,623	3.9	25,830
2038	6,679	3.9	26,048
2039	6,734	3.9	26,263

Table 3c: Total Projected Waste Generation for the City of Temiskaming Shores

Planning Year	Total Volume of Uncompacted Waste (A+B) (m^3)	Calculated Tonnage of Uncompacted Waste[3] (tonne)	Calculated Volume of Compacted Waste[4] (m^3)	Cumulative Volume of Compacted Waste (m^3)
2009	38,749	5,812	19,373	19,373
2010	39,171	5,876	19,587	38,960
2011	39,594	5,939	19,797	58,757
2012	40,020	6,003	20,010	78,767
2013	40,441	6,066	20,220	98,987
2014	40,867	6,130	20,433	119,420
2015	41,290	6,194	20,647	140,067
2016	41,712	6,257	20,857	160,924
2017	42,138	6,321	21,070	181,994
2018	42,561	6,384	21,280	203,274
2019	42,980	6,447	21,490	224,764
2020	43,407	6,511	21,703	246,467
2021	43,829	6,574	21,913	268,380
2022	44,256	6,638	22,127	290,507
2023	44,678	6,702	22,340	312,847
2024	45,101	6,765	22,550	335,397
2025	45,525	6,829	22,763	358,160
2026	45,948	6,892	22,973	381,133
2027	46,370	6,956	23,187	404,320
2028	46,797	7,020	23,400	427,720
2029	47,219	7,083	23,610	451,330
2030	47,645	7,147	23,823	475,153
2031	48,068	7,210	24,033	499,186
2032	48,487	7,273	24,243	523,429
2033	48,914	7,337	24,457	547,886
2034	49,336	7,400	24,667	572,553
2035	49,759	7,464	24,880	597,433
2036	50,185	7,528	25,093	622,526
2037	50,608	7,591	25,303	647,829
2038	51,031	7,655	25,517	673,346
2039	51,454	7,718	25,727	699,073

Notes:

1. Population estimated based on linear extrapolations of population growth calculated from 1991, 1996, 2001 and 2006 census data, as provided by Statistics Canada for the City of Temiskaming Shores and the Town of Cobalt
2. Uncompacted (i.e., pre-landfilled) waste quantity estimates for 2008 provided by the City of Temiskaming Shores
3. Tonnage based a typical density value of 150 kg/m^3 for uncompacted residential solid waste (McBean et. al., 1995).
4. Volume based on an the conservative assumption that landfilled and compacted residential solid waste has an in-place density of 300 kg/m^3.

TABLE 4

SUMMARY OF PROJECT NEEDS
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Project Planning Criteria	Value
Planning Period	30 years (2009 to 2039)
Uncompacted Waste Density (Typ.)	150 kg/m^3
In-place Compacted Waste Density	300 kg/m^3

Summary of Projected Waste Quanitities	By Cubic Meter
Long-term Solid Waste Disposal Volume Requirement (landfilled and compacted)	699,073
Long-term Daily Cover Soil Volume Requirement	177,000
Long-term Landfill (Waste & Cover Soil) Capacity Requirement	873,841
Remaining Haileybury Landfill (Waste and Cover Soil) Capacity	188,691
Preliminary Design Landfill (Waste and Cover Soil) Expansion Capacity	685,150
Preliminary Design Landfill (Waste and Cover Soil) Expansion Capacity (roun	685,000

TABLE 5

SUMMARY OF PRELIMINARY DESIGN CRITERIA
FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Preliminary Design Component	Criteria
Buffer Zones	Min. 30 m between limit of waste and property boundary
Base Contours	Excavate soil quantity sufficient to provide daily cover for landfill expansion and appropriate hydrogeologic setting
Final Cover & Contours	Top Elevation = 280 metres above sea level (masl)
	Min. 600 mm thick clay layer
	Min. 150 mm thick vegetated topsoil
	Max. Slope = 4:1 (Side Slopes)
	Min. Slope = 20:1 (Top Plateau)
Landfill Expansion Capacity	Min. 685,000 m^3
Daily Cover Soil Volume Requirement	Min. 177,000 m^3
Groundwater/Leachate Management	Natural Attenuation
Surface Water Management	Perimeter Drainage Ditches and Final Cover Grading
Landfill Gas Management	To be established for landfills with a total capacity of 1.5 million cubic meters or greater

Note:

Criteria based on standards outlined in Ontario Regulation 347, Ontario Regulation 232/98, Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfills Sites (MOE, 1998) and Landfill Gas Capture: A Guideline on the Regulatory and Approval Requirements for Landfill Gas Capture Facilities (MOE, 2008)

TABLE 6

DETERMINATION OF INFLATION RATE FROM NON-RESIDENTIAL BUILDING CONSTRUCTION PRICE INDEX FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY CITY OF TEMISKAMING SHORES

Date	Ottawa-Gatineau, Ontario part, Ontario/Quebec		Toronto, Ontario		Combined AONRBCPI
	Total NRBCPI	Average Annual NRBCPI	Total NRBCI	Average Annual NRBCI	
1999/02	102.9	104.1	103.0	104.3	208.4
1999/05	103.8		104.1		
1999/08	104.5		104.8		
1999/11	105.0		105.3		
2000/02	106.3	110.5	107.0	112.4	222.9
2000/05	110.1		112.1		
2000/08	112.0		114.1		
2000/11	113.7		116.2		
2001/02	113.8	114.6	116.3	117.3	231.9
2001/05	115.0		117.8		
2001/08	115.1		118.0		
2001/11	114.5		117.2		
2002/02	115.9	116.6	118.5	119.4	236.0
2002/05	116.1		118.9		
2002/08	116.4		119.4		
2002/11	118.1		120.8		
2003/02	119.4	120.8	122.2	123.8	244.6
2003/05	120.7		123.7		
2003/08	121.3		124.2		
2003/11	121.8		125.2		
2004/02	124.0	127.4	127.6	132.0	259.4
2004/05	126.3		130.7		
2004/08	129.0		133.9		
2004/11	130.4		135.7		
2005/02	130.5	132.9	135.8	139.0	271.9
2005/05	131.9		137.7		
2005/08	133.8		140.3		
2005/11	135.4		142.0		
2006/02	137.3	140.8	144.2	148.3	289.1
2006/05	139.7		147.3		
2006/08	142.2		150.0		
2006/11	144.0		151.6		
2007/02	146.6	150.2	154.2	158.3	308.5
2007/05	150.6		158.5		
2007/08	151.4		159.6		
2007/11	152.1		160.8		
2008/02	134.0	140.1	138.4	145.3	285.4
2008/05	140.6		146.5		
2008/08	143.8		149.2		
2008/11	141.8		147.0		
2009/02	140.7	140.0	144.6	142.5	282.5
2009/05	140.2		142.9		
2009/08	139.6		141.6		
2009/11	139.6		140.9		

NRBCPI Index Location	2009 NRBCPI Index Value	1999 NRBCPI Index Value	10-Year Average Inflation Rate
NRBCPI (Toronto)	142.5	104.3	3.33%
NRBCPI (Ottawa-Gatineau)	140.0	104.1	3.14%
Combined AONRBCPI	282.5	208.4	***3.23%***

Source:

Statistics Canada. Table 327-0039 - Price indexes of non-residential building construction, by class of structure, quarterly (index, 1997=100) (table), CANSIM (database).

Notes:

NRBCPI = Non-Residential Building Construction Price Index
AONRBCPI = Average Ontario Non-Residential Building Construction Price Index

TABLE 7

BREAKDOWN OF ESTIMATED PRELIMINARY DESIGN CAPITAL CONSTRUCTION COSTS (LOW)
FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item	Land Acquisition Activity	Unit	Unit Cost	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
1	Purchase land for the extension of the current Contaminant Attenuation Zone (CAZ)[(1)]	ha	$ 1,000.00	2	One-Time	$ 2,000

Item	Landfill Cell Construction Activity (per Phase)	Unit	Unit Cost[(2)]	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
2	Site Preparation (includes provision of insurance, bonding, mobilization, demobilization and clearing and grubbing of vegetation)	L.S.	$ 10,000.00	1	Periodic	$ 10,000
3	Excavation to landfill cell base grades (includes loading, hauling, stockpiling, grading and compaction of native soil)	cu.m	$ 5.00	43,800	Periodic	$ 219,000
4	Excavation of perimeter access road and perimeter surface water diversion ditching (includes loading, hauling, stockpiling, grading and compaction of native soil subgrade)	cu.m	$ 5.00	100	Periodic	$ 500
5	Construct perimeter landfill access road (includes loading, hauling, placement, grading and compaction of Granular "B" subbase)	lin.m.	$ 20.00	100	Periodic	$ 2,000
6	Construct perimeter landfill access road (includes loading, hauling, placement, grading and compaction of Granular "A" base)	lin.m.	$ 20.00	100	Periodic	$ 2,000
7	Application of final 600 mm thick initial clay cover layer (includes loading, hauling, placement and grading clay material)	sq.m.	$ 6.00	19,400	Periodic	$ 116,400
8	Application of final 150 mm thick topsoil cover (includes loading, hauling, placement and grading toposil quality material)	sq.m.	$ 3.00	19,400	Periodic	$ 58,200
9	Application of hydroseed on final topsoil cover (includes loading, hauling and placement of grass seed mix)	sq.m.	$ 1.00	19,400	Periodic	$ 19,400

Note:
1. Based on typical price per hectare for land in Northern Ontario.
2. Unit cost estimates based on AMEC's database of "Low" unit costs for similar construction activities.

TABLE 8

PRELIMINARY DESIGN PRESENT VALUE CAPITAL CONSTRUCTION COST ESTIMATE (LOW)
FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item Number[1]		1	2	3	4	5	6	7	8	9	Total Expenses (Row Sum)	Present Value of Total Expenses (2010 $CAD)
One-time Payments		$ 2,000										
Annual Payments			$ 10,000	$ 219,000	$ 500	$ 2,000	$ 2,000	$ 116,400	$ 58,200	$ 19,400		
Periodic Payments												
Inflation Rate[2]		3.23%										
Planning Year	**Year No.**											
2009	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2010	2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2011	3	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2012	4	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2013	5	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2014	6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2015	7	$ 2,420	$ 12,101	$ 265,021	$ 605	$ 2,420	$ 2,420	$ -	$ -	$ -	$ 284,987	$ 284,987
2016	8	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2019	11	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2020	12	$ -	$ 14,186	$ 310,677	$ 709	$ 2,837	$ 2,837	$ -	$ -	$ -	$ 331,246	$ 331,246
2021	13	$ -	$ -	$ -	$ -	$ -	$ -	$ 170,461	$ 85,230	$ 28,410	$ 284,101	$ 284,101
2022	14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2023	15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2024	16	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2025	17	$ -	$ 16,630	$ 364,199	$ 832	$ 3,326	$ 3,326	$ -	$ -	$ -	$ 388,313	$ 388,313
2026	18	$ -	$ -	$ -	$ -	$ -	$ -	$ 199,827	$ 99,913	$ 33,304	$ 333,044	$ 333,044
2027	19	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2028	20	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2029	21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2030	22	$ -	$ 19,495	$ 426,942	$ 975	$ 3,899	$ 3,899	$ -	$ -	$ -	$ 455,210	$ 455,210
2031	23	$ -	$ -	$ -	$ -	$ -	$ -	$ 234,252	$ 117,126	$ 39,042	$ 390,420	$ 390,420
2032	24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2033	25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2034	26	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2035	27	$ -	$ 22,854	$ 500,493	$ 1,143	$ 4,571	$ 4,571	$ -	$ -	$ -	$ 533,632	$ 533,632
2036	28	$ -	$ -	$ -	$ -	$ -	$ -	$ 274,608	$ 137,304	$ 45,768	$ 457,680	$ 457,680
2037	29	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2038	30	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2039	31	$ -	$ -	$ -	$ -	$ -	$ -	$ 302,086	$ 151,043	$ 50,348	$ 503,477	$ 503,477
											Total	***$ 3,962,110***
											Total Estimate (2010 $CAD Rounded Value)	**$ 3,962,000**

Notes:
1. List of Activities and representative numbers are presented on Table 7.
2. Inflation Rate based on the Average Ontario Non-Residential Building Construction Price Index as outlined on Table 6.

TABLE 9

BREAKDOWN OF ESTIMATED PRELIMINARY DESIGN CAPITAL CONSTRUCTION COSTS (HIGH)
FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item	Land Acquisition Activity	Unit	Unit Cost	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
1	Purchase land for the extension of the current Contaminant Attenuation Zone (CAZ)[(1)]	ha	$ 1,000.00	4	One-Time	$ 4,000

Item	Landfill Cell Construction Activity	Unit	Unit Cost[(2)]	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
2	Site Preparation (includes provision of insurance, bonding, mobilization, demobilization and clearing and grubbing of vegetation)	L.S.	$ 60,000.00	1	Periodic	$ 60,000
3	Excavation to landfill cell base grades (includes loading, hauling, stockpiling, grading and compaction of native soil)	cu.m	$ 10.00	28,400	Periodic	$ 284,000
4	Excavation of perimeter access road and perimeter surface water diversion ditching (includes loading, hauling, stockpiling, grading and compaction of native soil subgrade)	cu.m	$ 10.00	100	Periodic	$ 1,000
5	Construct perimeter landfill access road (includes loading, hauling, placement, grading and compaction of Granular "B" subbase)	lin.m.	$ 100.00	100	Periodic	$ 10,000
6	Construct perimeter landfill access road (includes loading, hauling, placement, grading and compaction of Granular "A" base)	lin.m.	$ 60.00	100	Periodic	$ 6,000
7	Application of final 600 mm thick initial clay cover layer (includes loading, hauling, placement and grading clay material)	sq.m.	$ 15.00	19,400	Periodic	$ 291,000
8	Application of final 150 mm thick topsoil cover layer(includes loading, hauling, placement and grading toposil quality material)	sq.m.	$ 7.00	19,400	Periodic	$ 135,800
9	Application of hydroseed on final topsoil cover (includes loading, hauling and placement of grass seed mix)	sq.m.	$ 5.00	19,400	Periodic	$ 97,000

Note:
1. Based on typical price per hectare for land in Northern Ontario.
2. Unit cost estimates based on AMEC's database of "High" unit costs for similar construction activities.

TABLE 10

PRELIMINARY DESIGN PRESENT VALUE CAPITAL CONSTRUCTION COST ESTIMATE (HIGH)
FOR THE PROPOSED EXPANSION OF THE NEW LISKEARD LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item Number[1]		1	2	3	4	5	6	7	8	9	Total Expenses (Row Sum)	Present Value of Total Expenses (2010 $CAD)
One-time Payments		$ 4,000										
Annual Payments			$ 60,000	$ 284,000	$ 1,000	$ 10,000	$ 6,000	$ 291,000	$ 135,800	$ 97,000		
Periodic Payments												
Inflation Rate[2]		3.23%										
Planning Year	Year No.											
2009	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2010	2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2011	3	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2012	4	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2013	5	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2014	6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2015	7	$ 4,841	$ 72,608	$ 343,680	$ 1,210	$ 12,101	$ 7,261	$ -	$ -	$ -	$ 441,701	$ 441,701
2016	8	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2017	9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2018	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2019	11	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2020	12	$ -	$ 85,117	$ 402,887	$ 1,419	$ 14,186	$ 8,512	$ -	$ -	$ -	$ 512,121	$ 512,121
2021	13	$ -	$ -	$ -	$ -	$ -	$ -	$ 426,152	$ 198,871	$ 142,051	$ 767,074	$ 767,074
2022	14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2023	15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2024	16	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2025	17	$ -	$ 99,781	$ 472,295	$ 1,663	$ 16,630	$ 9,978	$ -	$ -	$ -	$ 600,347	$ 600,347
2026	18	$ -	$ -	$ -	$ -	$ -	$ -	$ 499,567	$ 233,131	$ 166,522	$ 899,220	$ 899,220
2027	19	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2028	20	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2029	21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2030	22	$ -	$ 116,970	$ 553,660	$ 1,950	$ 19,495	$ 11,697	$ -	$ -	$ -	$ 703,772	$ 703,772
2031	23	$ -	$ -	$ -	$ -	$ -	$ -	$ 585,630	$ 273,294	$ 195,210	$ 1,054,134	$ 1,054,134
2032	24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2033	25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2034	26	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2035	27	$ -	$ 137,121	$ 649,041	$ 2,285	$ 22,854	$ 13,712	$ -	$ -	$ -	$ 825,013	$ 825,013
2036	28	$ -	$ -	$ -	$ -	$ -	$ -	$ 686,520	$ 320,376	$ 228,840	$ 1,235,736	$ 1,235,736
2037	29	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2038	29	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2039	30	$ -	$ -	$ -	$ -	$ -	$ -	$ 731,585	$ 341,406	$ 243,862	$ 1,316,853	$ 1,316,853
											Total	***$ 8,355,971***
											Total Estimate (2010 $CAD Rounded Value)	**$ 8,356,000**

Notes:
1. List of Activities and representative numbers are presented on Table 9.
2. Inflation Rate based on the Average Ontario Non-Residential Building Construction Price Index as outlined on Table 6.

TABLE 11

BREAKDOWN OF ESTIMATED PRELIMINARY DESIGN CAPITAL COSTS (LOW)
FOR THE PROPOSED EXPANSION OF THE HARLEY TOWNSHIP LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item	Landfill Access Activity	Unit	Unit Cost (2010 $CAD)	Quantity	Payment Basis	Estimated Cost (2010 $CAD)
1	Payment for obtaining access to deposit waste at Harley Township Landfill	L.S.	$ 200,000.00	1	One-Time	$ 200,000

Item	Landfill Disposal Activity	Unit	Unit Cost	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
2	Annual Cost of disposal operations at Harley Township Landfill	tonne	$ 25	9,786	Annual (from 2017 to 2039)	$ 244,650

TABLE 12

**PRELIMINARY DESIGN PRESENT VALUE CAPITAL COST ESTIMATE (LOW)
FOR THE PROPOSED EXPANSION OF THE HARLEY TOWNSHIP LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES**

Item Number[1]		1	2	Total Expenses (Row Sum)	Present Value of Total Expenses (2010 $CAD)
One-time Payments		$ 200,000			
Annual Payments			$ 244,650		
Periodic Payments					
Inflation Rate[2]		3.23%			
Planning Year	**Year No.**				
2009	1	$ -	$ -	$ -	$ -
2010	2	$ -	$ -	$ -	$ -
2011	3	$ -	$ -	$ -	$ -
2012	4	$ -	$ -	$ -	$ -
2013	5	$ -	$ -	$ -	$ -
2014	6	$ -	$ -	$ -	$ -
2015	7	$ -	$ -	$ -	$ -
2016	8	$ 249,845	$ -	$ 249,845	$ 249,845
2017	9	$ -	$ 315,495	$ 315,495	$ 315,495
2018	10	$ -	$ 325,686	$ 325,686	$ 325,686
2019	11	$ -	$ 336,205	$ 336,205	$ 336,205
2020	12	$ -	$ 347,065	$ 347,065	$ 347,065
2021	13	$ -	$ 358,275	$ 358,275	$ 358,275
2022	14	$ -	$ 369,847	$ 369,847	$ 369,847
2023	15	$ -	$ 381,793	$ 381,793	$ 381,793
2024	16	$ -	$ 394,125	$ 394,125	$ 394,125
2025	17	$ -	$ 406,855	$ 406,855	$ 406,855
2026	18	$ -	$ 419,997	$ 419,997	$ 419,997
2027	19	$ -	$ 433,563	$ 433,563	$ 433,563
2028	20	$ -	$ 447,567	$ 447,567	$ 447,567
2029	21	$ -	$ 462,023	$ 462,023	$ 462,023
2030	22	$ -	$ 476,947	$ 476,947	$ 476,947
2031	23	$ -	$ 492,352	$ 492,352	$ 492,352
2032	24	$ -	$ 508,255	$ 508,255	$ 508,255
2033	25	$ -	$ 524,672	$ 524,672	$ 524,672
2034	26	$ -	$ 541,618	$ 541,618	$ 541,618
2035	27	$ -	$ 559,113	$ 559,113	$ 559,113
2036	28	$ -	$ 577,172	$ 577,172	$ 577,172
2037	29	$ -	$ 595,815	$ 595,815	$ 595,815
2038	30	$ -	$ 615,059	$ 615,059	$ 615,059
				Total	***$ 10,139,344***
				Total Estimate (2010 $CAD Rounded Value)	**$ 10,139,000**

Notes:

1. List of Activities and representative numbers are presented on Table 11.

2. Inflation Rate based on the Average Ontario Non-Residential Building Construction Price Index as outlined on Table 6.

TABLE 13

BREAKDOWN OF ESTIMATED PRELIMINARY DESIGN CAPITAL COSTS (HIGH)
FOR THE PROPOSED EXPANSION OF THE HARLEY TOWNSHIP LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Item	Landfill Access Activity	Unit	Unit Cost (2010 $CAD)	Quantity	Payment Basis	Estimated Cost (2010 $CAD)
1	Payment for obtaining access to deposit waste at Harley Township Landfill	L.S.	$ 300,000.00	1	One-Time	$ 300,000

Item	Landfill Disposal Activity	Unit	Unit Cost	Quantity	Payment Basis	Estimated Cost[1] (2010 $CAD)
2	Annual Cost of disposal operations at Harley Township Landfill	tonne	$ 35	9,786	Annual (from 2017 to 2038)	$ 342,510

TABLE 14

**PRELIMINARY DESIGN PRESENT VALUE CAPITAL COST ESTIMATE (HIGH)
FOR THE PROPOSED EXPANSION OF THE HARLEY TOWNSHIP LANDFILL
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES**

Item Number[1]		1	2	Total Expenses (Row Sum)	Present Value of Total Expenses (2010 $CAD)
One-time Payments		$ 300,000			
Annual Payments			$ 342,510		
Periodic Payments					
Inflation Rate[2]		3.23%			
Planning Year	**Year No.**				
2009	1	$ -	$ -	$ -	$ -
2010	2	$ -	$ -	$ -	$ -
2011	3	$ -	$ -	$ -	$ -
2012	4	$ -	$ -	$ -	$ -
2013	5	$ -	$ -	$ -	$ -
2014	6	$ -	$ -	$ -	$ -
2015	7	$ -	$ -	$ -	$ -
2016	8	$ 374,768	$ -	$ 374,768	$ 374,768
2017	9	$ -	$ 441,693	$ 441,693	$ 441,693
2018	10	$ -	$ 455,960	$ 455,960	$ 455,960
2019	11	$ -	$ 470,687	$ 470,687	$ 470,687
2020	12	$ -	$ 485,891	$ 485,891	$ 485,891
2021	13	$ -	$ 501,585	$ 501,585	$ 501,585
2022	14	$ -	$ 517,786	$ 517,786	$ 517,786
2023	15	$ -	$ 534,510	$ 534,510	$ 534,510
2024	16	$ -	$ 551,775	$ 551,775	$ 551,775
2025	17	$ -	$ 569,598	$ 569,598	$ 569,598
2026	18	$ -	$ 587,996	$ 587,996	$ 587,996
2027	19	$ -	$ 606,988	$ 606,988	$ 606,988
2028	20	$ -	$ 626,593	$ 626,593	$ 626,593
2029	21	$ -	$ 646,832	$ 646,832	$ 646,832
2030	22	$ -	$ 667,725	$ 667,725	$ 667,725
2031	23	$ -	$ 689,293	$ 689,293	$ 689,293
2032	24	$ -	$ 711,557	$ 711,557	$ 711,557
2033	25	$ -	$ 734,540	$ 734,540	$ 734,540
2034	26	$ -	$ 758,266	$ 758,266	$ 758,266
2035	27	$ -	$ 782,758	$ 782,758	$ 782,758
2036	28	$ -	$ 808,041	$ 808,041	$ 808,041
2037	29	$ -	$ 834,141	$ 834,141	$ 834,141
2038	30	$ -	$ 861,083	$ 861,083	$ 861,083
				Total	***$ 14,220,066***
				Total Estimate (2010 $CAD Rounded Value)	**$ 14,220,000**

Notes:

1. List of Activities and representative numbers are presented on Table 13.

2. Inflation Rate based on the Average Ontario Non-Residential Building Construction Price Index as outlined on Table 6.

TABLE 15

FEASIBILITY ASSESSMENT CRITERIA AND EVALUATION
FOR THE PROPOSED PRELIMINARY LANDFILL EXPANSION ALTERNATIVES
FEASIBILITY STUDY FOR
DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY
CITY OF TEMISKAMING SHORES

Criteria	Indicator	Expansion of New Liskeard Landfill Alternative No. 1	Expansion of Harley Township Landfil Alternative No. 2
Public Health, Safety and Socioeconomic Factors			
Residential Areas	Distance to nearest residence	3	2
Sensitive Land Uses	Number of residences within 400 m and 1000 m of landfill	3	2
	Distance to nearest agricultural lands		
	Distance to nearest Environmental Protection (EP) Zone		
	Distance to nearest designated Hazard Lands and Sensitive Areas		
Drinking Water Supply	Distance to nearest designated drinking water supply area	2	0
	Distance to nearest drinking water supply well		
Accessibility and Driving Distance	Distance to waste centroid/waste generation source	0	2
	Distance to nearest existing road		
	Sub-Total	***8***	***6***
Natural Environment			
Terrestrial Habitat	Distance to nearest wetland, swamp, bog, marsh or fen	0	0
	Distance to nearest potentially significant terrestrial habitat (e.g., old growth forest)		
Aquatic Habitat	Distance to nearest water course, creek, ponds or lake	0	0
Species at Risk	Distance to nearest known or potential Species At Risk or its critical habitat	0	0
Hydrogeological Conditions	Presence of on-site groundwater recharge area	3	3
	Existing and degree of groundwater contamination		
	Degree of natural containment at site		
	Number of aquifers		
	Distance to aquifer		
	Sub-Total	***3***	***3***
Technical Considerations			
Site Size	Size of conceptual landfill expansion	1	1
Leachate Management	Size of proposed contaminant attenuation zone	1	3
	Complexity of alternative leachate management system		
Surface Water Management	Size and complexity of surface water management features	1	1
Landfill Gas Management	Requirement for landfill gas collection and management	0	1
	Sub-Total	***3***	***6***
Preliminary Capital Cost Estimate			
Capital/Construction Cost	Cost estimate to construct the landfill expansion at the New Liskeard Site, or to obtain access to the Harley Township Landfill	2	5
	Sub-Total	***2***	***5***
	Total	***16***	***20***

Notes:

Ranking scores for each Feasibility Assessment Sub-Criteria is based on the following Level of Concern/Potential Impact Rating: 0-none, 1-low, 2-low to medium, 3-medium, 4-medium to high, 5-high.

See Section 7.0 for the full rationale behind each score.

Conceptual Alternative No. 1 involves the expansion of the New Liskeard Landfill to the east of the existing landfill footprint and the expansion of the existing contaminant attenuation zone (See Figures 4, 5 and 7)

Conceptual Alternative No. 2 involves the expansion of the Harley Township Landfill property (see Figure 3).

TABLE 16

RANGE OF PRELIMINARY ENVIRONMENTAL ASSESSMENT ACT APPROVAL COST ESTIMATES FOR THE PROPOSED PRELIMINARY LANDFILL EXPANSION ALTERNATIVES FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY CITY OF TEMISKAMING SHORES

Environmental Assessment Act Approval Tasks	Preliminary Engineering Cost Estimates		Comments
	Low	High	
Development/approval of a Terms of Reference	$ 20,000	$ 50,000	Cost dependent on level of interest by stakehoders, number of public meetings, Aboriginal community interest and complexity of public issues/concerns.
Public/Stakeholder Consultation	$ 45,000	$ 65,000	
Baseline Studies, Description of the Existing Environment	$ 40,000	$ 95,000	Costs dependent on quality of available backround and complexity of intrusive investigative programs.
Development.evaluation of "Alternatives To" and "Alternative Methods"	$ 5,000	$ 15,000	Costs dependent on the implementation of a "focused" EA proces.
Detialed description of the Undertaking	$ 15,000	$ 30,000	Costs dependent of level/complexity of the preliminary design of the preferred alternative.
Effects Assessment, Mitigation and Monitoring Plans	$ 5,000	$ 15,000	Cost dependent of the complexity of the effects, mitigation strategies and monitoring requirements.
Reporting	$ 15,000	$ 25,000	Costs dependent on level of effort associated with all other tasks
Total	**$ 145,000**	**$ 295,000**	

TABLE 17

RANGE OF PRELIMINARY ENVIRONMENTAL PROTECTION ACT APPROVAL COST ESTIMATES FOR THE PROPOSED PRELIMINARY LANDFILL EXPANSION ALTERNATIVES FEASIBILITY STUDY FOR DEVELOPMENT OF A LONG-TERM LANDFILL DISPOSAL STRATEGY CITY OF TEMISKAMING SHORES

Environmental Protection Act Approval Tasks	Preliminary Cost Estimates		Comments
	Low	High	
Hydrogeolgical Assessment	$ 20,000	$ 50,000	Cost dependent on the scope and findings of the hydrogeolgical assessment and level of complexity of the landfill design and operations strategies.
Design & Operations Plan	$ 30,000	$ 70,000	
Total	**$ 50,000**	**$ 120,000**	

APPENDIX A

Certificate of Approval No. A571505, New Liskeard Landfill, dated 9 May 2000, amended 27 April 2005 and 17 April 2007

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: MAY 9/00
Revokes/Repeals: _____

Ministry of the Environment

Environmental Assessment and Approvals Branch
2 St. Clair Ave. W., 12A Floor
Toronto ON M4V 1L5

Ministère de l'Environnement

Direction des évaluations environnementales et des autorisations
2, avenue St. Clair W., 12A étage
Toronto ON M4V 1L5

Tel/Tél (416) 314-6979
Fax/Téléc (416) 314-8452

Ontario

1

May 9, 2000

1) ACCESS TO SITE ?
2) NO BURNING OF WASTE ?
3) NO HAZARDOUS WASTE ?
4) HYDROGEOLOGICAL REPORT
5) O/M PLAN
6) CLOSURE PLAN
7) ANNUAL REPORT

Mr. Kenneth D.N. Boal, AMCT, CMC
Chief Administrative Officer
The Corporation of the Town of New Liskeard
P.O. Box 730, 90 Whitewood Avenue
New Liskeard, Ontario
P0J 1P0

Dear Sir:

Re: Certificate of Approval No. A 571505
Corporation of the Town of New Liskeard

Please find enclosed the new Provisional Certificate of Approval for the New Liskeard Landfill Site.

If you have any questions regarding this matter, please call Mr. E. Zaltsberg of my staff at (416)314-8342.

Sincerely,

A. Dominski, P. Eng.
Supervisor, Waste Unit

Encl.
EZ/nb
c.: District Manager, Timmins

Copied to Dan.
June 9/00

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

The Corporation of the Town of New Liskeard
P.O. Box 730, 90 Whitewood Avenue
New Liskeard, Ontario
P0J 1P0

for the use and operation of a 2.02 hectare landfilling area within a 32 hectare total site area.

all in accordance with the following plans and specifications:

as listed in Schedule "A"

Located: West ½ of Lot 5, Concession 2
Corporation of the Town of New Liskeard

which includes the use of the site only for the Processing and Disposal *of the following categories of waste (Note: Use of the site or additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* domestic, commercial and non-hazardous solid industrial waste

and subject to the following conditions:

For the purpose of this Provisional Certificate of Approval:

(a) "Certificate" means this Provisional Certificate of Approval including its schedules, if any, issued in accordance with the Environmental Protection Act;

(b) "Director" means a Director of the Environmental Assessment and Approvals Branch of the Ministry;

(c) "Regoinal Director" means the Director, Thunder Bay Regional Office of the Northern Region of the Ministry;

(d) "District Manager" means the District Manager of the Timmins District Office of the Northern Region of the Ministry;

(d) "Ministry" means the Ontario Ministry of the Environment, unless specific reference is made to another Ministry;

(e) "Town" means the Corporation of the Town of New Liskeard;

(g) "Provincial Officer" means a person who is designated by the Ministry of Environment as a Provincial Officer for the purposes of the Environmental Protection Act, the Ontario Water Resources Act, the Pesticides Act, and their respective regulations;

(h) "Site" means the facility described in the application for this Provisional Certificate of Approval and in the supporting documentation referred to herein;

(i) "ODWO" means the Ontario Drinking Water Objectives; and

(j) "RUP" means the Ministry's Reasonable Use Policy (Policy 15-08).

GENERAL

(1) Except as otherwise provided by these conditions, the Site shall be designed, developed, used, maintained and operated, and all facilities, equipment and fixtures shall be built and installed, in accordance with the Application for a Certificate Approval for a Waste Disposal Site dated April 12, 2000 and supporting documentation, and plans and specifications listed in Schedule "A".

(2) The requirements specified in this Provisional Certificate of Approval are the requirements under the Environmental Protection Act, R.S.O. 1990. The issuance of this Provisional Certificate of Approval in no way abrogates the Town's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and other legislation and regulations.

(3) The requirements of this Provisional Certificate of Approval are severable. If any requirement of this Provisional Certificate of Approval, or the application of any requirement of this Provisional Certificate of Approval to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of this Provisional Certificate of Approval shall not be affected in any way.

(4) The Town shall ensure compliance with all the terms and conditions of this Provisional Certificate of Approval. Any non-compliance constitutes a violation of the Environmental Protection Act, R.S.O. 1990 and is grounds for enforcement.

(5) (a) The Town shall, forthwith upon request of the Director, District Manager, or Provincial Officer (as defined in the Act), furnish any information requested by such persons with respect to compliance with this Provisional Certificate of Approval, including but not limited to, any records required to be kept under this Provisional Certificate of Approval; and

(b) In the event the Town provides the Ministry with information, records, documentation or notification in accordance with this Provisional Certificate of Approval (for the purposes of this condition referred to as "Information"),

(i) the receipt of Information by the Ministry;
(ii) the acceptance by the Ministry of the Information's completeness or accuracy; or
(iii) the failure of the Ministry to prosecute the Town, or to require the Town to take any action, under this Provisional Certificate of Approval or any statute or regulation in relation to the Information

shall not be construed as an approval, excuse or justification by the Ministry of any act or omission of the Town relating to the Information, amounting to non-compliance with this Provisional Certificate of Approval or any statute or regulation.

(6) The Town shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to:

(a) carry out any and all inspections authorized by Section 156, 157 or 158 of the Environmental Protection Act, R.S.O. 1990, Section 15, 16 or 17 of the Ontario Water Resources Act, R.S.O. 1990, or Section 19 or 20 of the Pesticides Act, R.S.O. 1990, as amended from time to time, of any place to which this Provisional Certificate of Approval relates; and,

without restricting the generality of the foregoing, to:

(b) (i) enter upon the premises where the records required by the conditions of this Provisional Certificate of Approval are kept;
(ii) have access to and copy, at reasonable times, any records required by the conditions of this Provisional Certificate of Approval;
(iii) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations required by the conditions of this Provisional Certificate of Approval; and
(iv) sample and monitor at reasonable times for the purposes of assuring compliance with the conditions of this Provisional Certificate of Approval.

(7) (a) Where there is a conflict between a provision of any document referred to in Schedule "A", and the conditions of this Provisional Certificate of Approval, the conditions in this Provisional Certificate of Approval shall take precedence; and

(b) Where there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall prevail.

(8) The Town shall ensure that all communications/correspondence made pursuant to this Provisional Certificate of Approval includes reference to the Provisional Certificate of Approval No. A 571505.

(9) The Town shall notify the Director in writing of any of the following changes within thirty (30) days of the change occurring:

(a) change of Town or Owner of the Site or both;
(b) change of address or address of the new Town;
(c) change of partners where the Operator or Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, 1991 shall be included in the notification to the Director;

(d) any change of name of the corporation where the Operator or Owner is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (form 1 or 2 of O. Reg. 182, Chapter C-39, R.R.O. 1990 as amended from time to time), filed under the Corporations Information Act shall be included in the notification to the Director; and

(e) change in directors or officers of the corporation where the Operator or Owner is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" as referred to in 9(d), supra.

(10) In the event of any change in ownership of the Site, the Town shall notify, in writing, the succeeding owner of the existence of this Provisional Certificate of Approval, and a copy of such notice shall be forwarded to the Director.

(11) Any information relating to this Provisional Certificate of Approval and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, R.S.O. 1990, C. F-31.

(12) All records and monitoring data required by the conditions of this Provisional Certificate of Approval must be kept on the Town's premises for a minimum period of two (2) years from the date of their creation.

OPERATIONAL

(13) This Certificate revokes all previously issued Certificates for this Site.

(14) The Town shall ensure that the Site is operated by trained personnel in a safe and secure manner, and that the wastes are properly handled, so as not to pose any threat to the general public, Site personnel or the environment, and that access to the Site is limited to the Town and his staff.

(15) Within ninety (90) days of the issuance of this Certificate, the Town shall mark the Site boundaries, as identified in the site plan included with the application and supporting documents, with permanent markers, that shall be erected so as to be visible throughout the year for the life of the Site.

(16) The Town shall ensure that no burning of waste shall take place at the Site.

(17) All waste received at the Site under the authority of this Certificate shall be deposited within a 2.02 hectare landfilling area shown on Sheets A and B, provided with the Application for the Certificate.

(18) The Site shall be closed when final contours shown on Sheet B and reduced by 0.9m for final cover, have been reached.

(19) Liquid industrial waste or hazardous waste as defined in Ont. Reg. 347 shall not be received or deposited at the Site.

(20) The Town shall operate a litter maintenance program, which will include the collection and proper disposal of any wind blown or vector borne litter, from off-site deposition locations and from those areas of the Site that are not being actively landfilled.

(21) (a) The Town shall:

i) Within 60 days of the date of this Certificate, submit to the Director, for the Director's signature, two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Forms 4 & 5 of O. Reg. 14/92; and

ii) Within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration; and

(b) Pursuant to Section 197 of the Environmental Protection Act, neither the Owner nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

(22) Within 18 (eighteen) months of the issuance of this Certificate, the Town shall submit for the Director's approval a hydrogeological report. This report shall include but not limited to the following issues:

(a) groundwater regime evaluation (hydraulic gradients, direction of groundwater flow, groundwater flow velocity);
(b) the extent of the existing groundwater contaminant plume;
(c) monitoring requirements; and
(d) contaminant attenuation zone requirements.

(23) Within two years of the issuance of this Certificate, the Town shall submit for the Director's approval an Operation and Maintenance Plan. This Plan shall include but not be limited to the following issues:

(a) the Site capacity approved in accordance with the Ministry's protocol;
(b) total in situ waste volume;
(c) the remaining life of the Site;
(d) new final contours reflecting the capacity defined in (a);
(e) the final cover installation in the Fill Beyond Approved Limit (FBAL) areas and its schedule;
(f) Site operations including daily and final cover;
(g) the groundwater monitoring program; and
(h) the closure plan.

(24) The Site shall be operated, maintained and monitored in accordance with the approved Operation & Maintenance Plan required by Condition 23.

(25) Two years before the Site is expected to stop receiving waste, the Town shall submit for the Director's approval an updated Closure Plan. This Plan shall include, but not be limited to the following issues:

(a) the choice of final cover material;
(b) changes to the final contour plan that may be previously identified in the annual reports, or recommended in the Closure Plan;
(c) the sequence and schedule for final cover installation;
(d) post-closure and end-use plans which reflect an after-use of conservation and passive recreation;
(e) schedules for Site inspections;
(f) plans and schedules for post-closure groundwater and surface water monitoring programs; and
(g) plans and schedules for the routine monitoring and maintenance of the final cover.

(26) The Town shall prepare and submit an annual report to the Regional Director by June 1st of the year following the calendar year covered by the report which shall include as a minimum, the following:

(a) a summary of total annual quantities of waste received at the Site;
(b) a drawing(s) of the Site indicating all groundwater monitoring locations;
(c) tables outlining monitor locations, analytical parameters sampled, and frequency of sampling;
(d) an analysis and interpretation of groundwater monitoring data; a review of the adequacy of the monitoring program; conclusions of the monitoring data; and recommendations for any changes in monitoring program that may be necessary;
(e) an assessment of groundwater quality in relation to the RUP and ODWO;
(f) an assessment of the efficiency of the Contaminant Attenuation Zone established;
(g) an update of changes in operations, equipment, or procedures made or produced at the Site, and any operating difficulties encountered;
(h) drawings showing areas of fill, buffer areas, current Site contours, maximum final Site contours, any recommended changes of the final contours of the Site, percentage of available space utilized, and an estimate of the remaining disposal capacity and Site life;
(i) a statement as to compliance with all Conditions and with the inspection and reporting requirements of the Conditions;
(j) summary of any complaints made regarding Site operation and the Town's response and action taken; and
(k) recommendations respecting any proposed changes in the operation of the Site.

COMPLAINT PROCEDURES

(27) If at any time, the Town receives complaints regarding the operation of the Site, the Town shall respond to these complaints according to the following procedures:

(a) The Town shall record each complaint on a formal complaint form entered in a sequentially numbered log book. The information recorded shall include the nature of the complaint, the name, address and the telephone number of the complainant and the time and date of the complaint;

(b) The Town, upon notification of the complaint shall initiate appropriate steps to determine all possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and

(c) The Town shall retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any recommendations for remedial measures, and managerial or operational changes to reasonably avoid the re-occurrence of similar incidents.

SCHEDULE "A"

This Schedule "A" forms part of this Provisional Certificate of Approval:

1. The updated Application for a Certificate of Approval for a Waste Disposal Site dated April 12, 2000;
2. Letters from Sutcliffe Rody Quesnel Inc. to the MOE dated February 4, 2000, March 14, 2000 and April 12, 2000;
3. Site Plan Approved Area (Sheet A) and Site Plan Final Contours (Sheet B) prepared by Sutcliffe Rody Quesnel Inc. and dated February 2000;

The reasons for the imposition of these Conditions are as follows:

(1) The reason for Condition (1) is to ensure that the Site is operated in accordance with the application and supporting documentation submitted by the Town, and not in a manner which the Director has not been asked to consider.

(2) The reason for Conditions (2), (3), (4), (5), (7), (8), (9), (10), (11) and (12) is to clarify the legal rights and responsibilities of the Town.

(3) The reason for Condition (6) is to ensure that the appropriate Ministry staff have ready access to information and the operations of the Site which are approved under this Provisional Certificate of Approval. Condition (6) is supplementary to the powers of entry afforded a Provincial Officer pursuant to the Environmental Protection Act, the Ontario Water Resources Act, and the Pesticides Act, as amended.

(4) The reason for Condition (13) is to ensure that this Certificate revokes all previously issued Certificates for this Site.

(5) The reason for Conditions (14) and (20) is to ensure that the Site is operated in an environmentally safe manner.

(6) The reason for Condition (15) is to allow a viable on-site inspection to realize the limits of the Site during any season.

(7) The reason for Condition (16) is to reduce potential damage and environmental effects due to fire.

(8) The reason for Conditions (17), (18), (19) and (24) is to ensure that this Site is operated in accordance with the application and submitted documentation listed in Schedule A.

(9) The reason for Condition (21) requiring registration of the Provisional Certificate of Approval is that Section 46 of the Environmental Protection Act, R.S.O. 1990, prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used for waste disposal, unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future users of the Site and the environment from any hazards which might occur as a result of waste being disposed of on the Site. This prohibition and potential hazard should be drawn to the attention of future owners and users of the Site by the Provisional Certificate of Approval being registered on title.

(10) Condition (22) is to ensure that the Town shall conduct and submit for the Director's approval a hydrogeological report.

(11) The reason for Condition (23) is to ensure that the Town shall develop and submit for the Director's approval an Operation and Maintenance Plan.

(12) The reason for Condition (25) is to ensure that two years before the Site is closed, the Town shall submit for the Director's approval an updated Closure Plan.

(13) The reason for Condition (26) is to ensure that the Town shall prepare and submit an annual report to the Regional Director by June 1st of the year following the calendar year covered by the report.

(14) The reason for Condition (27) is to ensure that the complaints are responded to in a systematic manner to protect the health and safety of the public and the environment.

You may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19, as amended, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary,*
Environmental Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario.
M4P 1E4

AND

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor,
Toronto, Ontario.
M4S 1H2

*Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board by: Tel: (416) 314-4600, Fax: (416) 314-4506 or e-mail: www.ert.gov.on.ca.

DATED AT TORONTO this 9th *day of* May, 2000.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

EZ/nb
c.: District Manager, Timmins District Office

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: APR 25/05
Revokes/Repeals: AMENDS A571505

600-20-07

Ministry of the Environment / Ministère de l'Environnement

Ontario

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A571505
Notice No. 1

cc: [redacted]
Ken P. Burley
Dave Treen

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

Site Location: New Liskeard Landfill
West 1/2 of Lot 5, Concession 2, Dymond Twp
Temiskaming Shores City, District of Timiskaming

You are hereby notified that I have amended Provisional Certificate of Approval No. A571505 issued on May 9, 2000 for a waste disposal site (landfill), as follows:

I. The name of the Owner has changed:

From: **The Corporation of the Municipality of New Liskeard**

To: **The Corporation of the City of Temiskaming Shores**

II. The service area for this site is hereby changed to the municipal boundary of the City of Temiskaming Shores.

III. The hours of operation are hereby changed to 8:00am-12:00pm, Tuesday through Saturday.

All in accordance with the Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 19, 2004, signed by Dan Harvey, Director of Public Works, City of Temiskaming Shores, including all supporting documentation.

The reason for this amendment to the Certificate of Approval is as follows:

1. To approve the Owner's requests.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A571505 dated May 9, 2000

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as

amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

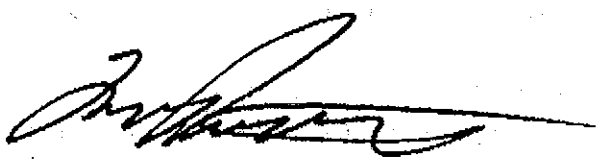
AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 27th day of April, 2005



Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, P.Eng., Sutcliffe Rody Quesnel Inc.

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: APR 17/07
Revokes/Repeals: NOTICE #2

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A571505
Notice No. 2
Issue Date: April 17, 2007

APR 2 6 2007

To: Dave Treen.
April 30, 2007.
CWQ

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

Site Location: New Liskeard Landfill
West 1/2 of Lot 5, Concession 2, Dymond Twp
Temiskaming Shores City, District of Temiskaming

You are hereby notified that I have amended Provisional Certificate of Approval No. A571505 issued on May 9, 2000 and amended April 27, 2005 for a waste disposal site (landfill), as follows:

I. This Certificate is hereby amended to recognize the addition of a contaminant attenuation zone.

II. The following Item is hereby added to Schedule "A":

4. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 14, 2005 and signed by Dave Treen, Manager of Environmental Services, City of Temiskaming Shores, including the attached drawing entitled "New Liskeard Landfill Site Figure 1" showing the attenuation zone.

The reason for this amendment to the Certificate of Approval is as follows:

1. To recognize the addition of the contaminant attenuation zone as required by Provincial Officer's Order No. 7026-6GQLJY.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A571505 dated May 9, 2000, as amended.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to eachportion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 17th day of April, 2007

Tesfaye Gebrezghi, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, Sutcliffe Rody Quesnel Inc.

APPENDIX B

Certificate of Approval No. A570402, Haileybury Landfill Site, dated 10 November 1998, amended 27 April 2005

Location: HAIL. LANDFILL
C of A #: A570402 Issue Date: NOV 10/98
Revokes/Repeals: A570402 (MAR 5/92)

Ministry of the Environment
250 Davisville Avenue
Toronto ON M4S 1H2

Ministère de l'Environnement
250, avenue Davisville
Toronto ON M4S 1H2

Ontario

ENVIRONMENTAL ASSESSMENT AND APPROVALS BRANCH
3RD FLOOR
Tel. (416) 314-7967
Fax (416) 314-8452

November 10, 1998

Mr. G. Douglas Walsh, CET
Director of Public Works
Town of Haileybury
Postal Bag "D", 451 Meridian Avenue
Haileybury, Ontario
P0J 1K0

Dear Mr. Walsh:

Re: Amended Provisional Certificate of Approval for a Waste Disposal Site No. A 570402 for a Landfill Site Located on S ½ Lot 1, Concession 2, in the Town of Haileybury

Please find attached the Amended Provisional Certificate of Approval for a Waste Disposal Site No. A 570402.

The draft Certificate of Approval presented to the Environmental Assessment Board, (Board), during the hearing under Part V of the Environmental Assessment Act, has been adopted by the Board with a number of conditions added upon the request from the Board. In addition, we have made some clarifying changes to the wording. All of the changes from the draft dated April 24, 1998, (Exhibit No.11) are listed below:

1. Definition No. 1(3) has been changed to correct the name of the local district office.

2. Definition No. 1(4) has been added to define the Drainage Act, since its use is required in the condition required by the Board. The remaining definitions have been re-numbered.

3. Definition No. 1(6) has been expanded to clarify the extend of the Fill Area.

4. Condition No. 4(1) has been changed to fully define the Pesticides Act.

5. Condition No. 6 has been changed to incorporate the recommendation from the Board, to require a construction of the stormwater management works within a 12-month time frame.

.../2

6. Condition No. 11 has been added to incorporate the recommendation from the Board, to require an installation of a perimeter fence. The remaining conditions have been re-numbered.

7. Condition No.15 has been changed to clarify the units used to describe the depth of the cover material.

8. Condition No. 17 has been changed to clarify the units used to describe the depth of the cover material.

9. Condition No. 18 has been added to require a submission of a clean wood handling plan, to further investigate the need for an installation of a pit incinerator suggested by the Board.

10. Sub-condition No. 22(2) has been changed to incorporate the recommendation from the Board, by adding lead to the groundwater testing parameters.

11. Sub-condition No. 22(3) has been changed to incorporate the recommendation from the Board, by adding suspended solids to the surface water testing parameters and by requiring another surface water testing location.

12. Sub-condition No. 22(4) has been added to describe the location of the additional monitoring station required by the Board. The remaining sub-conditions have been re-numbered.

13. Condition No. 23 has been changed to incorporate the recommendation from the Board, to require an installation of methane monitors at the garage, operator's office and other permanent structures at the site within a 3-month deadline.

14. Condition No. 27 has been changed, by replacing "Item 2" to "Item 3", to correct a typographical error.

15. Condition No. 27 has been changed, to correct the title of Guideline B-7.

16. Document No. 5 has been added to Schedule "A", since it provided clarification to the definition of the Fill Area. The remaining documents have been re-numbered.

If you have any questions on the above, please call Margaret Wojcik, P.Eng., Senior Review Engineer, Waste Section, at (416) 314-7993.

Yours truly,

A. Dominski, P. Eng.
Manager, Waste Section

MW/st
Encls.
cc: District Manager, Timmins District Office
Isabelle O'Connor, Legal Services Branch
Robert M. Fishlock, Blake, Cassels & Graydon

You are hereby notified that Provisional Certificate of Approval No. A 570402 for a Waste Disposal Site (Landfill), dated March 5, 1992, is hereby revoked in its entirety and the following substituted therefor:

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Town of Haileybury
Postal Bag "D", 451 Meridian Avenue
Haileybury, Ontario
P0J 1K0

for the use and operation of a 5.8 hectare Landfill Site within a 32.4 hectare total Site area;

all in accordance with the following plans and specifications:

listed in Schedule "A";

Located: S ½ Lot 1, Concession 2
Town of Haileybury
District of Timiskaming

which includes the use of the site only for the disposal *of the following categories of waste (Note: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* municipal waste;

and subject to the following conditions:

DEFINITIONS

1. In this Provisional Certificate of Approval:

   (1) "Certificate" means this Amended Certificate of Approval No. A 570402, as amended from time to time, including all Schedules attached to and forming part of this Certificate;

(2) "Director" means the one or more persons who, from time to time, are so designated for the purpose of Part V of the *Environmental Protection Act*, R.S.O. 1990, c.E.19;

(3) "District Manager" means the District Manager of the Timmins District Office of MOE;

(4) "Drainage Act" means the *Drainage Act*, R.S.O. 1990, c.D. 17;

(5) "EPA" means the *Environmental Protection Act*, R.S.O. 1990, c.E. 19;

(6) "Fill Area" means the portion of the Site where waste may be disposed as delineated by the "Limit of Sanitary Landfill Fill Area" shown on Sheet 10 of Item 2 in Schedule "A" and described in Item 5 in Schedule "A";

(7) "MOE" means the Ministry of the Environment;

(8) "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c.O. 40;

(9) "Regional Director" means the Director, Northern Region, Ministry of the Environment;

(10) "Town" means the Corporation of the Town of Haileybury; and

(11) "Site" means the 32.4 hectare landfill site including the Fill Area and buffer zone on Lot 1, Concession 2, in the Township of Bucke, District of Timiskaming as shown on the Plan of Survey, Sheet No. 2 of Item 2 in Schedule "A".

GENERAL REQUIREMENTS

2. This Certificate revokes all previously issued Provisional Certificates of Approval issued under Part V, EPA, for this Site. The approval given herein, including the Terms and Conditions set out, replaces all previously issued approvals and related Terms and Conditions under Part V, EPA for this Site.

3. The requirements of this Certificate are severable. If any requirement of this Certificate to any circumstance is held invalid, the application of such requirement to other circumstance and the remainder of this Certificate shall not be affected thereby.

4. The Town shall allow MOE personnel, or a MOE authorized representative(s), upon presentation of credentials, to:

(1) carry out any and all inspections authorized by the EPA, OWRA, or the *Pesticides Act*, R.S.O. 1990, c.P. 11, as amended from time to time, of any place to which this Certificate relates, and without restricting the generality of the foregoing, to:

a. enter upon the premises or the location where the records required by the conditions of this Certificate are kept;

b. have access to and copy, at any reasonable time, any records required by the conditions of this Certificate;

c. inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices or operations required by the conditions of this Certificate; and

d. sample and monitor, at reasonable times, for the purposes of assuring compliance with the conditions of this Certificate.

5. (1) The Site shall be developed, operated and maintained by the Town in accordance with the Terms and Conditions herein and items 1 to 4 listed in Schedule "A" of this Certificate.

(2) Should there be any discrepancies between any of items 1 to 4 of Schedule "A" and the conditions in this Certificate, the conditions shall take precedence. Should there be discrepancies between items 1 to 4 listed in Schedule "A", the document bearing the most recent date shall take precedence.

STORMWATER MANAGEMENT WORKS APPROVALS

6. (1) This Certificate does not provide an approval for any works subject to approval under the OWRA, the Drainage Act, or any other legislation that may be applicable.

(2) The Town shall complete the construction of the swale ditches, the sedimentation ponds, and the diversion ditch as outlined in Section 3.2 of Item 3 of Schedule "A", within 12 months from the issuance of this Certificate. Town Completed

(3) Within six months of the date of issuance of this Certificate, the Town shall submit to the Director an application for approval under the OWRA of the on-site stormwater management works. The Town shall fulfill the requirements under the Drainage Act, or any other legislation that may be applicable. HSL

CONTAMINANT ATTENUATION ZONE

7. Within twelve months from the date of issuance of this Certificate, the Town shall either acquire or obtain an easement and all of the water rights to the land described as: Town HSL

Parcel 904 NND
Part of the South Half of Lot 1
Concession 2
Township of Firstbrook
District of Timiskaming

CERTIFICATE OF PROHIBITION

8. (1) For the purpose of this condition "Property" means the Site and, effective on the date of acquisition of the land or acquisition of the easement and water rights by the Town, the parcel of land referred to in Condition No. 7, above.

(2) Pursuant to Section 197 of the EPA, neither the Town nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

(3) The Town shall,

a. within 60 days of the date of the date that the Town obtains the easement and water rights required under Condition No. 7, submit to the Director for the Director's signature two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Form 1 of O. Reg. 14/92; and Town

b. within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office and submit to the Director immediately following registration the duplicate registered copy. Town

LIMITS OF WASTE

9. (1) Waste disposal shall be limited to the Fill Area.

(2) Waste may only be placed above ground level to the final contour elevations shown on Sheet No. 10 of Item 2 of Schedule "A".

(3) Waste may only be placed below ground level in trenches as shown on Sheet No. 4 of Item 2 of Schedule "A" and to depths of approximately 3 metres below ground level but not exceeding 3.66 metres.

(4) There shall be no further final disposal of waste in the Bulk Material Storage Area shown on Sheet No. 10 of Item 2 of Schedule "A".

WASTE TYPE

10. Only municipal waste, as defined in Ontario Regulation 347, R.R.O. 1990 (as amended), may be disposed of at the Site.

SITE SECURITY AND OPERATING HOURS

11. The Town shall install a complete perimeter fence within 18 months from the issuance of this Certificate.

12. (1) The Site shall not be operated outside of the hours of 9:00 a.m. to 5:00 p.m., Monday to Friday, and from 9:00 a.m. to 12:00 noon on Saturday. The Site will be closed on Sundays and statutory holidays. These operating hours may be varied with the approval of the Regional Director.

(2) During non-operating hours, the Site entrance gate shall be kept locked.

(3) Except for waste deposited in the after-hours dumping bin located outside of the Site gate, waste shall only be received under the supervision of a Site attendant.

13. The Town shall ensure that all Site attendants are adequately trained with respect to the following:

(1) terms, conditions and operating requirements of this Certificate;

(2) the operation and management of the Site;

(3) relevant waste management regulations and legislation;

(4) environmental concerns related to the waste being handled at the Site; and

(5) occupational health and safety concerns pertaining to the management of waste at the Site.

OPERATIONAL REQUIREMENTS

14. The Town shall ensure that waste is deposited in a manner that minimizes the size of the Fill Area working face and that the waste is compacted before cover material is applied.

15. (1) All exposed waste shall be covered by a minimum of 15 centimetres of cover material at the end of each working day.

(2) A cover material layer of at least 30 centimetre-depth shall be applied as soon as reasonably possible on all areas of waste disposal where no final cover has been applied and where no additional waste or final cover is to be placed for six months or more.

16. Alternative materials to clean soil may be used as daily cover only if approval is obtained in accordance with the "Procedure for Gaining Approval to use Alternative Materials to Soil as Daily Cover in Landfills that Receive Only Municipal and Non-Hazardous Solid Wastes" (May, 1994) released by the Science and Technology Branch of the MOE or if approval is obtained in accordance with subsequent MOE procedures, guidelines or regulations.

17. (1) Where final waste contours have been reached for a given cell of the Site, final cover application and seeding shall be completed as soon as practical but not later than nine months from the completion of cover application.

(2) Except where Phase II development is scheduled to begin above a trench within one year of filling the trench, a 30 centimetre-thick layer of interim cover shall be placed above each trench as soon as practicable once it is filled and in any case within nine months of being filled. The interim cover shall be removed, to the extent practicable, and scarified prior to commencement of Phase II development.

18. The Town shall submit to the Director for approval, within three months from the issuance of this Certificate, a plan outlining the options for handling of clean wood at the Site. The plan shall contain the analysis of the environmental impacts of each option, and it shall identify the option preferred by the Town.

done

HSL complete

MONITORING WELLS

19. (1) Within three months of the issuance of this Certificate, a monitoring well to replace TW 7/94 and a monitoring well in the vicinity of Test Pit 14 shall be constructed and incorporated into the Site monitoring program.

done

Completed

(2) Any monitoring wells which are no longer needed or are operational shall be properly abandoned in accordance with Ontario Regulation 903, R.R.O. 1990 or rehabilitated within 3 months of such a determination being made.

(3) A report on the abandonment or rehabilitation of any monitoring well shall be included in the applicable Annual Report prepared in accordance with Condition No. 24 of this Certificate.

done

(4) The well development procedures and data for any new monitoring wells constructed at the Site shall be reported in the applicable Annual Report prepared in accordance with Condition No. ~~24~~ 25 of this Certificate.

Town

LITTER

20. (1) A visual inspection shall be made at least once each week of the public roadways immediately adjacent to the site and any litter

which may have originated from the Site or from vehicles hauling to the Site which is observed on the inspections, shall be retrieved forthwith.

(2) A visual inspection of the buffer zone shall be made at least once each month from April to October. Any litter present shall be retrieved and disposed of in the Fill Area.

SITE GRADING

21. Site grading and contours shall be maintained such that all surface water run-off from the buffer zone and areas capped with final cover is directed away from the working face of the Site.

SITE MONITORING

22. (1) Ground water shall be monitored three times per year in April/May, August/September and November/December at each of the following monitoring wells:

Replacement well for MW No. 2
TW 1/91(D)
TW 1/91(S)
TW 3/91
TW 4/91
TW 5/91
TW 6/94
TW 8/94
Replacement well for TW 7/94 as required by Condition No. 19(1)
Well to be constructed in the vicinity of Test Pit 14 as required by Condition No. 19(1).

(2) Each sample taken under Condition No. 22(1) shall be analysed for the following parameters:

Metals:	aluminium, arsenic, boron, barium, calcium, cadmium, chromium, copper, iron, potassium, magnesium, lead, manganese, sodium, selenium, strontium, mercury, zinc
Anions:	fluoride, chloride, nitrate, nitrite, phosphate, sulphate
Other Parameters:	(hardness) alkalinity, total Kjeldhal nitrogen (TKN), ammonia, total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved organic carbon (DOC), phenols
Field Parameters:	static level, temperature, conductance, pH

(3) Surface water samples shall be taken from monitoring stations SW1, SW2, SW3, SW4 and SW5 twice per year in April/May and August/September. For each sample, an analysis or determination shall be done for the following parameters:

Metals:	aluminium, boron, cadmium, chromium, cobalt, copper, iron, lead, nickel, potassium, sodium, zinc
Other Parameters:	alkalinity, ammonia, chloride, COD, DOC, phenols, TDS, turbidity, suspended solids
Field Parameters:	temperature, conductance, pH, dissolved oxygen, estimated streamflow

(4) The monitoring station SW5 shall be located at the outlet of a beaver dam just upstream of SW4.

(5) Changes to the monitoring requirements shall be made on the basis of recommendations made in the Annual Report and only with the Regional Director's written approval.

23. The Town shall install battery-operated methane gas monitors in the garage, operator's office and any other structure at the landfill, within 3 months from the issuance of this Certificate.

DAILY RECORDS

24. Daily records of Site operations shall be made and shall be kept at the Site for a period of at least two years from the date of the record. The daily records shall include the following:

(1) The type, hauler, vehicle license number and time of arrival for all waste received at the Site;

(2) All complaints from the public received by the Town and an indication of the action taken in response by the Town; and

(3) A record of litter collection activities, Site inspections and application of interim and daily cover.

ANNUAL REPORTS

25. Beginning with the 1998 calendar year, an Annual Report addressing water quality monitoring and Site operations shall be submitted to the Regional Director no later than April 30th following the calendar year being reported upon. The Annual Report shall include the following:

(1) tables outlining analytical parameters sampled and frequency of sampling for each monitoring location;

(2) summary data tables for key analytical parameters and locations;

(3) an analysis and interpretation of the groundwater monitoring results including a discussion of groundwater monitoring data in relation to compliance with the boundary criteria;

(4) a drawing of the Site and neighbouring land showing all monitoring locations;

(5) review of the current monitoring program and a recommendation for any changes;

(6) review of the sampling and analytical procedures, including the QA/QC programs;

(7) a summary of monthly and total annual waste loads received at the Site;

(8) drawings showing existing conditions, completed Fill Areas, buffer area, current Fill Area contours and maximum final Site contours;

(9) calculation of the volume of available space utilized, the remaining Site capacity, the volume of cover material applied and the waste compaction density;

(10) an estimate of the remaining Site life;

(11) an update of changes in Site operations, equipment, procedures and any operating difficulties encountered;

(12) a summary of any complaints made regarding Site operation and the Town's response and action taken; and

(13) recommendations respecting any proposed changes in the operation of the Site.

CLOSURE AND END USE PLANS

26. (1) Within five years of the commencement of landfilling in Phase II of Areas B, C & D of the Site, the Town shall submit a final Site closure and end use plan to the Director for approval.

(2) The Site closure and end use plans shall include, but not be limited to, details regarding the following:

a. proposed end use;

b. any adjustments to the final contour plan that may be recommended;

c. fencing and access control;

d. additional vegetative plantings planned;

e. the sequence and schedule for final cover installation;

f. plans and schedules for the management and continued monitoring;

g. plans and schedules for the routine monitoring and maintenance of the final cover and stormwater management works; and

h. notification procedures related to the Site closure.

CONTINGENCY PLANS

27. (1) Contingency plans as outlined in Section 4.15.2 of Item 3 of Schedule "A" shall be implemented in accordance with the criteria and procedures outlined in Section 4.0 of Item 6 of Schedule "A".

(2) Contingency plans as outlined in Section 4.15.2 of Item 3 of Schedule "A" shall be implemented if groundwater monitoring indicates that leachate migration has or will result in exceedance of the boundary criteria as determined from MOE Guideline B-7, "Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities", as amended.

SCHEDULE "A"

This Schedule "A" forms part of Provisional Certificate of Approval No. A 570402:

1. Application for a Certificate of Approval for a Waste Disposal Site (Landfill), signed by Alexander L. Herbert, Town of Haileybury, dated October 27, 1986.

2. Set of Plans entitled "Haileybury Landfill Site - Development, Operational and Closure Plans, Project No. E91008", prepared by H. Sutcliffe Limited, dated October 1992.

3. Report entitled, "Corporation of the Town of Haileybury, Landfill Site Approval Report, Project No. E91008", prepared by H. Sutcliffe Limited, revised July 1997.

4. Report entitled, "Supplemental Hydrogeological Investigation, Town of Haileybury Landfill Site, Haileybury, Ontario", prepared by International Water Consultants Ltd., dated April 3, 1995.

5. Letter dated November 19, 1996 from H.J. Hawken, H. Sutcliffe Ltd., to J. Connelly, Ministry of Environment and Energy, providing responses to Ministry's concerns from August 16, 1996.

6. Letter dated July 28, 1997 from H.J. Hawken, H. Sutcliffe Ltd., to J. Connelly, Ministry of Environment and Energy, providing responses to Ministry's concerns.

7. Report entitled, "Investigation of Proposed Leachate Attenuation Zone, Town of Haileybury Landfill Site, Haileybury, Ontario, 1997", dated February 18, 1997; prepared by International Water Consultants Ltd.

The reasons for the imposition of these conditions are as follows:

1. Conditions No. 1 through 27 have been included to adopt the decision of the Environmental Assessment Board. EP-97-05, dated October 2, 1998.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990 c. E-19, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, as amended provides that the Notice requiring a hearing shall state:

1. *The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;*
2. *The grounds on which you intend to rely at the hearing in relation to <u>each</u> portion appealed.*

In addition to these legal requirements, the Notice should also include:

3. *The name of the appellant;*
4. *The address of the appellant;*
5. *The Certificate of Approval number;*
6. *The date of the Certificate of Approval;*
7. *The name of the Director;*
8. *The municipality within which the waste disposal site is located;*

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary,
Environmental Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario
M4P 1E4

<u>AND</u>

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor,
Toronto, Ontario.
M4S 1H2

DATED AT TORONTO this 10th *day of* November, 1998.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

MW/st
cc: District Manager, Timmins

600 - 20 - 08

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A570402
Notice No. 1

RECEIVED
MAY - 9 2005

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

cc: Dan Harvey
Ken P. Zerby
Dave Treen

Site Location: Haileybury Landfill
Lot 1, Concession 2
Haileybury Town, District of Timiskaming
P0J 1K0

You are hereby notified that I have amended Provisional Certificate of Approval No. A570402 issued on November 10, 1998 and amended November 10, 1999 for a waste disposal site (landfill), as follows:

I. The name of the Owner has changed:

From: **The Corporation of the Municipality of Haileybury**

To: **The Corporation of the City of Temiskaming Shores**

II. The service area for this site is hereby changed to the municipal boundary of the City of Temiskaming Shores.

III. The hours of operation are hereby changed to 1:00pm-5:00pm, Tuesday through Saturday.

All in accordance with the Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 19, 2004, signed by Dan Harvey, Director of Public Works, City of Temiskaming Shores, including all supporting documentation.

The reason for this amendment to the Certificate of Approval is as follows:

1. To approve the Owner's requests.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A570402 dated November 10, 1998

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as

amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 27th day of April, 2005

Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, P.Eng., Sutcliffe Rody Quesnel Inc.

APPENDIX C

Certificate of Approval No. A571702, Harley Township Landfill Site, dated 23 October 1980, amended 6 May 2005

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A571702
Notice No. 1

The Corporation of the Township of Harley
Rural Route, No. 2
New Liskeard, Ontario
P0J 1P0

Site Location: Harley Township Waste Disposal Site
119114 Sale Barn Road
Harley Township, District of Timiskaming

You are hereby notified that I have amended Provisional Certificate of Approval No. A571702 issued on August 16, 1978 for the use, operation and establishment of a 8.1 hectare landfilling site, as follows:

- The District of Casey is added to the service area.

all in accordance with the application for a Certificate of Approval for a Waste Disposal Site dated December 16, 2004, signed by Michel Lachapelle, Township of Harley, and all supporting documentation associated with the application.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A571702 dated August 16, 1978

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation toeach portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 6th day of May, 2005

Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

RM/

c: District Manager, MOE Timmins
Michel Lachapelle, The Corporation of the Township of Harley

MITCHS.

REVISED

Provisional Certificate No. A 571702

C.C. J Hatton
D. Kemp
C - File in Book.

MP-13-02
Harley Tsp

Ministry of the Environment
Ontario

M.O.E.
NORTHEASTERN
JUL 23 1991
RECEIVED
TIMMINS

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Township of Harley
R.R. #2
New Liskeard, Ontario
P0J 1P0

for the use and operation of a 16.2 hectare landfilling site, 8.1 hectares to be used for landfilling

ENVIRONMENTAL APPROVALS BRANCH
RECEIVED
NOV 6 1980
MUNICIPAL & PRIVATE APPROVALS SECTION

all in accordance with the following plans and specifications:

As listed in Appendix A attached.

Located: S. Part of N.E.1/4 Lot 12, Concession 1
Township of Harley
District of Timiskaming

which includes the use of the site only for the disposal of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) domestic and commercial wastes.

and subject to the following conditions:

Dated this 23rd day of October, 1980.

Director, Section 39,
The Environmental Protection Act, 1971

APPENDIX "A"

1. The letter by Chester H. Edwards of the Township of Harley to the Ministry of the Environment dated July 12, 1978.

2. The drawing entitled "Sketch of Waste Disposal Site, E.½ of N.½ Lot 12, Concession 1, Township of Harley".

3. Site location Plan "A" dated July 19, 1978.

4. Site location Plan "B" dated July 19, 1978.

APPENDIX "A"

1. The letter by Chester H. Edwards of the Township of Harley to the Ministry of the Environment dated July 12, 1978.

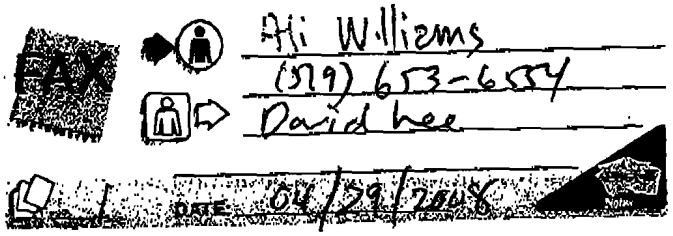
2. The drawing entitled "Sketch of Waste Disposal Site, E.1/2 of N.1/2 Lot 12, Concession 1, Township of Harley".

3. Site location Plan "A" dated July 19, 1978.

4. Site location Plan "B" dated July 19, 1978.

APPENDIX D

Approved Procedures for Deriving Inflation and Discount Rates for FA Calculations, dated February 2008



Inform

Approved Procedures for Deriving Inflation and Discount Rates for FA Calculations

The EAAB has approved updated derivation procedures for inflation and discount rates for use in FA calculations.

Inflation Rates

a)An inflation rate to represent all of Ontario is derived by computing the most recent 10-year averages for the Non-Residential Building Construction Price Indices for Toronto and for Ottawa-Gatineau (Ontario Part),
b)Adding the two 10-year averages together to form the 10-year Average Ontario Non-Residential Building Construction Price Index (AONRBCPI).

The references from www.Statscan.ca for these data are:
- Toronto = v7717845 - from Table 327-00391,2,3.
- Ottawa-Gatineau (Ontario Part) = v7717841 - from Table 327-00391,2,3.

For example, for the year 2007, the most recent 10-year annual data available for Toronto and Ottawa-Gatineau are for the years 1997- 2006 and yields a rate of 3.97%

Discount Rates

a)Compute the most recent 10-year annual average of Government of Canada benchmark bond yields, where Long Term is equal to 30 years. These rates are found at the Bank of Canada website, http://www.bankofcanada.ca/en/bond-look.htm.
b)The most recent 10-year annual average discount rate should be used for calculations during the first 30 years of the Planning Period for a landfill site, where the Planning Period is the operating period + post-closure contaminating lifespan.
c)For any period 31+ after closure, use a constant 3% real, long term discount rate.
d)Where 2006 is the most recent year for the 10-year average calculations,

i) for the first 30 years, the most recent 10-year average discount rate = 5.43%;
ii)for the remainder of the Planning Period (31 + years), use the 10-year average inflation rate plus a constant 3% real discount rate, eg. 3.97% + 3% = 6.97%.

Therefore, discount rates are changed once over the Planning Period rather than using a single, constant discount rate over the entire Planning Period of a facility.

February 2008