

# City of Sault Ste. Marie

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## **Solid Waste Management Environmental Assessment Alternative Methods – Step 2 (Identification and Comparison of Expansion Options) DRAFT Working Paper**

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February, 2012

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## 1.0 INTRODUCTION AND BACKGROUND

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

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

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

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

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

The evaluation of "alternatives to" was completed and is documented in the report titled "Alternatives to the Undertaking", June 2010. The "alternatives to" considered by Sault Ste. Marie were: increased waste diversion, landfill, incineration/high heat processes, export and "do nothing". Based on the evaluation that was undertaken, the preferred alternative is increased waste diversion in combination with additional landfill capacity to manage waste until at least 2049. This combination of alternatives is cost efficient and the most flexible to address changes in waste streams and enhanced 3R's initiatives.

A high heat process is also included in the City's waste management plan through the City's contractual relationship with a private sector energy-from-waste proponent, The Elementa Group (Elementa). The agreement is contingent on Elementa securing all necessary environmental and technical approvals and provides for processing of a portion of the residual municipal solid waste stream in Elementa's proposed steam reformation plant.

The evaluation of “alternative methods” relates to the landfill component of the solid waste management plan. Following the “alternatives to” evaluation, the next step in the EA process is the identification and evaluation of alternative methods of landfilling. This can include both alternative locations and alternative designs. The evaluation is carried out in two steps:

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

A draft working paper documenting the Step 1 activities was completed in April 2011 and consultation on the findings was carried out in April 2011. The evaluation and response from consultation concluded that an expansion of an existing landfill site is generally preferred over construction of a new site as it will:

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

This Alternative Methods - Step 2 Draft Working Paper relates to the identification and comparison of expansion options for the existing waste disposal site at 402 Fifth Line East in the City of Sault Ste. Marie.

## 1.1 Background

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

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

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

**Phase 1** identified a need for expansion of the City of Sault Ste. Marie waste diversion programs and is documented in the *Alternative Waste Diversion/Collection Systems Options Report* (June 2001). Many of the recommendations have now been implemented and as a result, the City has increased its residential diversion rate from approximately 9% in 1999 to 33 to 35% in recent years.

In addition, the City received funding through the Green Municipal Enabling Fund (GMEF) to undertake a feasibility study on co-composting residential organics, leaf and yard waste and municipal biosolids. The *Co-composting Pilot Study* report was finalized in February 2004 and an update is planned in 2012.

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

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

**Phase 3** of the study was completed in February 2003 with the release of the *Business and Implementation Plan*. This plan outlines the costs of expanded waste diversion programs and waste disposal and explores options to recover those costs. The result of this report was that Council approved the implementation of a partial pay-as-you-throw program with residential bag/container limits, bag fees, and increased gate and tipping fees at the landfill site. The City is committed to undertaking periodic updates to the Business and Implementation Plan to ensure it reflects program changes and adequate funds are budgeted to meet future requirements. An update is ongoing in 2012.

**Phase 4** resulted in the preparation of an *Environmental Assessment Terms of Reference* (July 2005), a required first step in the preparation of a Waste Management Environmental Assessment. Since that time, work has focused on enhanced 3R's initiatives and completing this EA.

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

## 1.2 Overview of the City's Waste Management System

The population serviced through the City's waste management system is approximately 75,400 residents<sup>1</sup>. Waste management services for this population include a combination of waste diversion programs and disposal facilities. Waste is currently disposed in the City landfill site located north of Fifth Line East and west of Kings Highway 17. The City has completed a Waste Quantities Report (June 2010) which documents historical waste quantities and predicts future residual waste disposal quantities. Based on this report, the existing disposal site life is projected to extend to approximately 2017.

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



The City has been leading active campaigns to reduce the amount of waste that residents generate with initiatives such as the plastic shopping bags campaign. This initiative educates residents to reduce the amount of plastic bags generated and encourages them to shop with reusable shopping bags instead. The City also provides a discounted beverage price to patrons that bring their own refillable cups to some of its venues within the City.

patrons that bring their own refillable cups to some of its venues within the City.

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

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

In addition, the City strongly encourages the business sector to comply with recycling mandates and implements strong programs in municipal facilities and at public events. The City also initiated a fluorescent light program that targets local businesses and the

<sup>1</sup> 2010 WDO Data Call

public to drop off bulbs to the Hazardous Waste Facility so they can be safely transported to a recycling facility.

An overview of the waste diversion programs is provided below.

- The City offers an extensive curbside recycling program which services approximately 23,833 single family households<sup>1</sup>. In addition the program services approximately 9,954 multi-residential units<sup>1</sup>. Recyclables are separated, by residents, into “containers” and “fibres” and set out curbside with their waste for collection on a weekly basis. The management and operation of the curbside recyclables program may change from a Municipal responsibility to a Stewards responsibility in the future. This change will impact the Municipality’s ability to influence the future curbside diversion rate. A decision on the future management and operation of this program has been delayed indefinitely.
- It is estimated that approximately 12,100<sup>1</sup> backyard composters have been distributed to residents in years past. The City also collects leaf and yard waste bi-weekly throughout the growing season (i.e.: late April to early November) and composts the feedstock in open windrows at the landfill site on Fifth Line. The final compost is used on City projects by the City’s Parks and Recreation Department.
- The City has banned leaf and yard waste and old corrugated cardboard (OCC) from the landfill.
- The City has also established a permanent Household Special Waste Facility (HSW) at the Public Works yard. The facility has been operational since 2001 and has been effective in diverting household hazardous waste generated within Sault Ste. Marie and surrounding areas. The management and operation of the HSW program became a Stewards responsibility in July, 2010. The City continues to own and operate the facility under a contract with the Stewards but this may change in the future.
- The City has implemented a staged reduction in residential waste set out limits. The City introduced a 4 bag/container limit on January 1, 2004 which was reduced to 3 bags/containers on May 1, 2004 and 2 bags/containers on January 1, 2005. 2011 tipping fees and gate fees at the landfill are \$70/tonne and \$8/visit respectively. In 2006 the City also reduced the permissible weight associated with the gate fee from 500 kg to 300 kg. The curbside waste set out limits, gate fee and tipping fee are currently under review in conjunction with the 2012 update to the Business and Implementation Plan.
- Separation and diversion of blue and yellow box recyclables, clean wood waste and brush, white goods, metals, propane tanks, tires, waste electrical and

electronic equipment (WEEE) and batteries is also completed at the City's landfill.

- A diversion event is staged by Clean North (a local environmental group) on an annual basis to facilitate the diversion of Christmas trees.
- Habitat for Humanity has established a ReStore for the sale of reusable household items and construction and renovation materials.
- A Community Recycling Depot was established in 2008. The Depot is operated by Community Living Algoma and accepts a broad range of electronics and styrofoam. Some products are accepted free of charge and others are accepted for a nominal fee.

Through these programs, approximately 11,016 tonnes of residential material was diverted from disposal in 2010. This represents a residential diversion rate of 33%.

The City has also initiated a Biosolids Management Study. The objective of the study is to review alternative biosolids management strategies and develop a sustainable and effective strategy that reduces the impact on the City's landfill, more effectively manages nuisance odours, has wide public support, is cost effective and environmentally responsible. The Study is scheduled to be completed in 2012.

A private sector energy-from-waste (EFW) proponent called The Elementa Group (Elementa) has built and tested a pilot steam reformation plant that converts municipal solid waste into a char and synthetic gas that can be used to generate electricity. The pilot testing was completed from 2007 to 2009 and Elementa intends to proceed with the construction of a new larger-scale facility, with an estimated annual throughput capacity of 30,000 to 35,000 tonnes. The City has entered into a waste supply agreement with Elementa to process a minimum 12,500 tonnes per year of the City's residential MSW for a minimum ten year period. The project implementation has been delayed indefinitely and the commencement date for accepting waste is currently unknown.

### 1.3 Residual Wastes to be Managed

A report entitled *Waste Quantity Projections and Existing Environmental Profile* was also prepared in June, 2010. This report estimated the future waste quantities requiring disposal within the service area over a 40-year planning period (2010 to 2049). The estimation of waste quantities takes into consideration population projections, residential waste generation and diversion rates, IC&I disposal rates and disposal requirements for municipal biosolids generated at waste water pollution control plants. **Table 1.1** shows the range of waste, by sector, that requires disposal in 2012 and 2049.

<b>Table 1.1 WASTE REQUIRING DISPOSAL</b>				
	<b>Residential (tonnes per year)</b>	<b>IC&amp;I (tonnes per year)</b>	<b>Biosolids<sup>1</sup> (tonnes per year)</b>	<b>TOTAL (tonnes per year)</b>
2012	21,995	42,672	10,474	<b>75,141</b>
2049	26,409	52,061	0	<b>78,470</b>

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

Over the 40-year study period, the City of Sault Ste. Marie would require additional disposal capacity of approximately 2.33 million tonnes. This information will be used in the alternative methods evaluation to determine the space required in a landfill to accommodate this quantity of residual waste.

Although there is the potential for a significant proportion of the City’s waste stream to be processed in the proposed Elementa steam reformation plant, there are some risks associated with the future implementation of this innovative project.

The proponents continue to negotiate with the Province of Ontario to secure an acceptable long term energy purchase agreement and have been unable to secure terms acceptable to them. In addition, assuming acceptable terms and conditions are negotiated, there will be challenges in developing, implementing and running a full scale plant on a continuous basis.

Based on the current and future challenges there is a risk that the project may not proceed to the implementation phase, or may not reach its intended capabilities. For these reasons it has been assumed, within the context of this Environmental Assessment, that all residual waste will be managed in a landfill site.

In the event the Elementa project is implemented and reaches partial or full capacity, there will continue to be a need to manage residual waste from the Elementa facility and residual waste that cannot be processed by Elementa due to capacity constraints. Elementa’s future success will not impact the need for landfill capacity but may impact the projected longevity of the expanded landfill.

## 2.0 GENERAL DESCRIPTION OF THE SITE EXPANSION OPTIONS

### 2.1 Description of Existing Landfill Site

There is currently one operating landfill site in Sault Ste. Marie (location is shown on **Figure 1**) located at 402 Fifth Line East. The site was developed, owned and operated by Cherokee Disposals and Construction Ltd. in the early 1960's.

An Environmental Assessment (EA) was undertaken by the City of Sault Ste. Marie (City) in 1983 and 1984 to evaluate alternative means of providing long-term waste disposal capacity for the City, the Township of Prince and the Rankin First Nation Reserve. The recommended Undertaking was the expansion of the Cherokee Landfill Site which would give the site additional waste disposal capacity for approximately 20 years. The assessment was approved and a Provisional Certificate of Approval (C of A) was issued in March of 1989 "for the use and operation of 44.6 hectare waste disposal site (landfilling) within a total site area of 83.6 hectares". The City purchased the landfill in 1989 and has been operating the site ever since. The site is licensed to accept domestic, commercial, non-hazardous solid industrial waste and processed organic waste within the City of Sault Ste. Marie, Township of Prince and Batchewana First Nation Rankin Reserve. In July 2009, the Provisional C of A was amended to include a 23.2 hectare contaminant attenuation zone adjacent to the western boundary. **Figure 1** contains a site plan of the onsite facilities and features.

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

It is noted that the in-situ waste density assumed in historical annual operation reports submitted to the MOE for the existing site is  $700 \text{ kg/m}^3$  and a 4:1 waste to cover ratio resulting in an apparent density of  $560 \text{ kg/m}^3$ .

As the site has been in operation for over four decades, there are extensive onsite facilities and features, including:

- Public access road;
- Inbound and outbound weigh scales;
- Scale house;
- Compost processing area;
- Drop-off areas for:
  - Public waste;
  - Wood waste;

- Tires;
- Shingles, construction and demolition materials;
- Batteries and propane tanks;
- WEEE; and
- Recyclables.
- Administration building;
- Maintenance garage;
- Internal access roads throughout the disposal area;
- Surplus materials stockpiles;
- Purge wells;
- Gravity leachate collection system;
- Groundwater monitoring wells;
- Active landfill gas wells and associated piping network;
- Blower station and central flare for the active landfill gas system;
- Leachate pump station;
- Storm water management pond; and
- Elementa Group waste-to-energy pilot plant (tenant).

## 2.2 Description of the Expansion Options

Step 2 of the Alternatives Methods evaluation considers options to expand the City's landfill site.

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

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

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

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

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

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

- Haul Route: Vehicles will continue to enter the site from Fifth Line and any potential disruptions to residents, businesses and agricultural/mining/forestry areas along the haul route will be the same for all options.
- Property Boundary: All expansion options are within the existing Sault Ste. Marie owned property.
- Setback Distance: All expansion options have a minimum 30 m setback distance from the property boundary.
- Lined Landfill Base: A liner will be installed for all new landfill cells and mined cells.
- Slope Stability Analysis: An analysis to assess the stability of all options will need to be completed. Side slopes of 4:1 (horizontal to vertical) and top slopes of 20:1 have been assumed for the waste fill and excavation side slopes of 3:1 have been assumed for the excavated cells.
- Quantity of Waste Disposed: As per the Waste Quantity Projections and Existing Environment Profile, June 2010 report, the landfill will be designed to manage a minimum of 2.33 million tonnes of waste. A landfill capacity of approximately 4.2 million m<sup>3</sup> is required to landfill this quantity of waste based on historic waste densities. (The capacity is calculated as 2.33 million tonnes / 0.56 tonnes/m<sup>3</sup> = 4.2 million m<sup>3</sup>.) Increased waste densities may be achieved through equipment and manpower enhancements.

The following sections provide a description of each proposed footprint expansion option. In the event that the assessment and evaluation of the expansion options does not result in an environmentally sound solution for Sault Ste. Marie's future waste management needs, then additional landfill site options would be identified and evaluated.

### 2.2.1 Option 1 – West Expansion

The West Expansion Option involves the expansion of the landfill from the western edge of the existing site towards the hydro corridor (**Figure 2**). The height of the expansion would be moderately higher than the existing landfill mass (approximately 2 m higher) and the average depth of expansion is 18 m.

Expansion to the west would require the relocation of the public drop off area, inbound and outbound scales, scale house and maintenance building. The existing

administration building could likely be maintained in its current location. **Table 2.1** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

The estimated disposal capacity available with Option 1 is 3.2 million m<sup>3</sup> (i.e. 1.79 million tonnes) assuming that current waste densities are achieved. To achieve the required capacity (4.2 million m<sup>3</sup>), this alternative includes a 30% increase in the in-situ density; i.e. 910 kg/m<sup>3</sup> in-situ waste density (728 kg/m<sup>3</sup> apparent density). It is expected that this density may be challenging to achieve and greater operational controls may be required such as the purchase of specialized compacting equipment.

The soil generated by the base excavation is expected to supply soil for cover needs (i.e. 1,280,000 m<sup>3</sup> (soil available) – 935,000 m<sup>3</sup> (daily, interim and final cover needs) = 345,000 m<sup>3</sup> surplus).

### 2.2.2 Option 2 – West and North Expansion A

Option 2 – West and North Expansion A allows for a western and northern expansion from parts of the western and northern limits of the existing landfill (**Figure 3**). This option also includes a vertical expansion of 4 m from the existing site and an average depth of the west expansion area of 18 m. At other sites that have been vertically expanded, the placement of a liner system on top of existing waste has been completed to reduce the impacts of expanding vertically on unlined areas (e.g., Ottawa Trail Road Landfill). Lining of the existing waste before vertically extending the fill area could also be included for this option. However, the amount of vertical expansion (4 m) is relatively modest in comparison to other sites where the vertical expansion has been more significant. For the purposes of the evaluation a liner over the existing waste has been included. Cross sectional drawings for this option are included in Figures 3.1 to 3.7 for reference. Similar drawings will be provided for the preferred option once confirmed.

By including a northerly expansion, this alternative preserves the public drop-off area, inbound and outbound weigh scales, scale house and maintenance building. **Table 2.1** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

The estimated disposal capacity is 4.2 million m<sup>3</sup> (i.e. 2.32 million tonnes) assuming that current waste densities are achieved. This option provides the target disposal capacity at current compaction rates reported at the existing landfill, i.e. in-situ waste density of 700 kg/m<sup>3</sup> or apparent density of 560 kg/m<sup>3</sup>. It is expected that this density can be achieved without greater operational controls.

The soil surplus generated by the base excavation is expected to supply soil for cover needs (i.e. 1,687,000 m<sup>3</sup> (soil available) – 1,259,000 m<sup>3</sup> (daily, interim and final cover needs) = 428,000 m<sup>3</sup> surplus).

### 2.2.3 Option 3 – West and North Expansion B

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

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

Expansion to the west would require the relocation of the public drop off area, inbound and outbound scales, scale house and maintenance building. **Table 2.1** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

The estimated disposal capacity is 4.2 million m<sup>3</sup> (i.e. 2.32 million tonnes) assuming that current waste densities are achieved. This option provides the target disposal capacity at current compaction rates reported at the existing landfill. It is expected that this density can be achieved without greater operational controls.

The soil surplus generated by the base excavation is expected to supply soil for cover needs (i.e. 1,687,000 m<sup>3</sup> (soil available) – 1,328,000 m<sup>3</sup> (daily, interim and final cover needs) = 359,000 m<sup>3</sup> surplus).

### 2.2.4 Option 4 – West and South Expansion

Option 4 – West and South Expansion involves two separate landforms for the expansion. The first is west of the western limit of the existing site and the second is south of the southern limit of the existing site (**Figure 5**). The height of the expansion site would be the same height as the existing site and the average depth of the west expansion is 18 m. Expansion to the south and west would require the relocation of the Elementa facility and blower station. **Table 2.1** presents a summary of the site features and infrastructure that may require relocation or removal as a result of this option.

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

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

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

**Table 2.1: Summary of Infrastructure Changes for Geometric Expansion Options**

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

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## 2.3 Landfill Mining

As part of the investigation of landfill expansion options, the City wanted to consider landfill mining. Landfill mining involves the excavation of existing disposed waste and cover material, recovering the cover material and returning the waste to the disposal footprint. Landfill mining has successfully been used in Ontario to create additional landfill capacity and/or to mitigate impacts to groundwater.

The City of Barrie was contacted to obtain information on their ongoing landfill mining project. The principle objective of their mining project is to protect groundwater with the installation of a landfill liner and a leachate collection system. The process involves the excavation of previously disposed waste and cover material. The mined waste is fed through screens which separate the coarse waste from the fine materials. Coarse waste is transported to the active landfill face, materials that can be recycled are separated and sent for further processing and the fines (primarily sand) are stockpiled for future use as daily cover. As a result of the landfill mining, it is anticipated that sufficient cover has been mined to reduce or eliminate the need for imported cover material.

On average, the City of Barrie is mining approximately 1,000 m<sup>3</sup> per day and estimate it will take between five and six years to mine 1.6 million m<sup>3</sup> of waste. Waste densities achieved before the re-engineering of the landfill were between 650 and 750 kg/m<sup>3</sup> and they estimate that the density has almost doubled since the in-situ waste had decayed, is much more malleable, and mixes well with fresh municipal solid waste. They estimate that mining has extended the life of their landfill by seven years.

Since the City of Barrie began landfill mining in Winter 2009 there have been a number of resident complaints regarding odour (e.g. during hot summer periods the City received up to 10 complaints per day). The Barrie landfill is proximal to residential areas on three sides (**Figure 6**). The City has taken measures to mitigate these issues through the use of masking agents, aerosols, and foam canons for cover, and limiting the area that is uncovered during the mining process. The City completed air quality assessments during the mining process and confirmed that they were within MOE air quality limits. The City is continuing to explore mitigation opportunities to reduce the odour and communication with surrounding neighbours is ongoing.

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

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## 3.0 EVALUATION METHODOLOGY AND CRITERIA

### 3.1 Methodology

The proposed methodology for the evaluation of the expansion options (alternative methods) and draft evaluation criteria were included in the EA Terms of Reference (ToR). As per the EA ToR, the evaluation is to be carried out to ensure that:

- The method is easy to understand;
- Results are clear and make sense based on the data collected;
- Decisions can be followed through the evaluation process; and
- The public has access to all data used in the evaluation.

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

1. **Preparation of Options** – Expansion options were prepared based on the constraints and characteristics of the existing landfill site. The expansion options were developed in sufficient detail to allow the identification of potential effects. The proposed site expansion options are described in Section 2 of this document.
2. **Collection of Data and Effects Assessment** - Data was collected and potential effects were assessed for each of the expansion options (Table 4.1). The potential effects identified represent those effects anticipated assuming a standard level of mitigation is put in place. The effects were described using a combination of quantitative (i.e. numeric) and qualitative (i.e. descriptive) data.

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

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

The assessment of the potential effects of each of the expansion options was based on a set of criteria/indicators. The criteria and indicators are intended to ensure that the evaluation of options and the resulting identification of a preferred option considers the potential positive or negative effects of the options on all aspects of

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the natural, social, and economic environment as well as technical considerations, cost and transportation effects.

In previous projects of a similar nature and as proposed in the Alternative Methods – Step 1 Draft Working Paper, the assessment would also include a site-specific area along the access route (in this case the principle access route is along the Trans Canada Highway – Great Northern Road and Fifth Line to the site entrance). However, since all expansion options are located on the same site there will not be any differences in impacts along the haul route. For this reason, evaluation of impacts along the haul route has been removed from the evaluation table.

3. **Comparison of Options by Indicator, Criteria and Criteria Group** – Criteria groups are general categories of effects such as Natural Environment, Social Environment, Cost, etc. Criteria describe the potential effects that are identified under each of these categories and indicators describe how the effect will be measured. Using the data collected, the expansion options have been ranked in order of preference for each indicator and criterion. In many cases, there was more than one indicator for each criterion. The technical disciplines ranked the options at an indicator level in order to come to a preliminary ranking for each criterion. Rankings will be confirmed once public, agency, First Nation and stakeholder input is received through the public consultation process.
4. **Overall Comparison of Options** – The expansion options will be comparatively evaluated based on each of the criteria groups – natural environment, social-cultural environment, economics, cost, technical and transportation,

This comparison will be completed in a two-step process. The first step will involve comparing Options 1 through 4 to identify the preferred geometry of the expansion footprint. If Option 1, 2 or 3 is selected as preliminary preferred, then the second step will involve comparing the preliminary preferred expansion option with and without a landfill mining component. In the event that Option 4 is identified as the preliminary preferred footprint option, then no further evaluation will be required.

The initial comparison was completed by the technical disciplines. These comparisons will be confirmed once public, agency, First Nation and stakeholder input is received through the public consultation process.

5. **Solicitation of Public Input** – Input on the expansion options and the preliminary evaluation results will be solicited through the public consultation process. This Step 2 – Draft Working Paper will be revised to document feedback received through the public consultation process and reissued as a Final Draft report with a final preferred option identified.
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6. **Selection of a Preferred Option** - The selection of a preferred expansion option involves considering input received through the public consultation process and identifying and making trade-offs amongst the advantages and disadvantages of the options. The option that on balance has the most advantages and least disadvantages will be recommended as the preferred expansion option and carried forward for detailed effects assessment and mitigation related work.

If the assessment and evaluation of the site options does not result in an environmentally sound solution for Sault Ste. Marie's future waste management needs, then additional landfill site options would be identified and evaluated.

Furthermore if an expansion option is identified but found to be unacceptable through the detailed impact assessment, to be completed in the next steps of the process, then additional landfill site options would be identified and evaluated.

### 3.2 Evaluation Criteria

**Table 3.1** presents the evaluation criteria used for the evaluation of alternative expansion options. These criteria were first presented in the EA Terms of Reference and were included in the Alternative Methods Step 1 Working Paper. It is noted that some changes have been made to the indicators and data sources to better reflect the options to be evaluated which includes:

- removal of indicators related to the evaluation of impacts along the access route since all options are within the existing property boundary and will continue to use the existing entrance;
- revision of indicators to evaluate groundwater and surface water impacts since all options are within the existing site;
- separation of residential disruption or displacement impacts from agricultural operations since it was thought that agricultural operations are better represented in impacts to businesses; and
- combination of three indicators in Cost criteria (estimated lifecycle cost of construction, operation and waste haulage) into one indicator (placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high).

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

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## **4.0 EVALUATION OF EXPANSION OPTIONS**

This chapter will describe the key differences between the expansion options and the preliminary results of the evaluation.

The off-site study areas are shown in Figures 7, 8, 9 and 10.

The initial evaluation of the four expansion options is shown in Table 4.1

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**Table 3.1**  
**ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA**

Criteria Group/Criteria	Indicators	Data Sources
<b>Natural Environment</b>		
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> of terrestrial features<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Area and significance of terrestrial features on site that would be displaced.</li> </ul>	<ul style="list-style-type: none"> <li>Aerial photos</li> <li>Field assessment</li> </ul>
	<ul style="list-style-type: none"> <li>Area and significance of terrestrial features off-site that may experience disruption effects during operation.</li> </ul>	<ul style="list-style-type: none"> <li>Aerial photos</li> <li>Field assessment</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> of aquatic features<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Amount and significance of aquatic habitat on-site that would be displaced or disrupted</li> </ul>	<ul style="list-style-type: none"> <li>Aerial photos</li> <li>Field assessment</li> </ul>
	<ul style="list-style-type: none"> <li>Amount and significance of aquatic habitat off-site that may be disrupted during operation</li> </ul>	<ul style="list-style-type: none"> <li>MNR mapping/fisheries data</li> <li>Aerial photos</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for effects on groundwater resources</li> </ul>	<ul style="list-style-type: none"> <li>Effect on management of existing site impacts</li> </ul>	<ul style="list-style-type: none"> <li>Discussion with City Staff</li> </ul>
	<ul style="list-style-type: none"> <li>Groundwater monitoring requirements</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater mapping</li> <li>Topographic mapping</li> </ul>
	<ul style="list-style-type: none"> <li>Contingency options for new fill area</li> </ul>	<ul style="list-style-type: none"> <li>Conceptual site design</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for effects on surface water resources</li> </ul>	<ul style="list-style-type: none"> <li>Effect on management of existing site impacts</li> </ul>	<ul style="list-style-type: none"> <li>Discussion with City Staff</li> </ul>
	<ul style="list-style-type: none"> <li>Surface water monitoring requirements</li> </ul>	<ul style="list-style-type: none"> <li>Surface water mapping</li> <li>Topographic mapping</li> <li>Field assessment</li> </ul>
	<ul style="list-style-type: none"> <li>Contingency options for new fill area</li> </ul>	<ul style="list-style-type: none"> <li>Conceptual site design</li> </ul>
<b>Social-Cultural Environment</b>		
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> to residents<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Number of residences on-site who would be displaced.</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Site review</li> </ul>

<sup>1</sup> Disruption includes consideration of nuisance effects (e.g. dust, noise, odour).

<sup>2</sup> Potential impacts along the access route were removed from the evaluation as all expansion options are within the existing property boundary and would be ranked equally.

**Table 3.1**  
**ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA**

Criteria Group/Criteria	Indicators	Data Sources
	<ul style="list-style-type: none"> <li>Number of residences off-site who may experience disruption effects (e.g. noise, dust, odour) during operation.</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Site review</li> </ul>
	<ul style="list-style-type: none"> <li>Character of the community in the vicinity of the site and potential for impact on that character</li> </ul>	<ul style="list-style-type: none"> <li>City input</li> <li>Land use mapping</li> <li>Site review</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> to community features (e.g. parks, recreational facilities)<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Number and type of community features on-site that would be displaced.</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Site review</li> </ul>
	<ul style="list-style-type: none"> <li>Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Land use mapping</li> <li>Site review</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for impact on future land use plans<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Area and designation of land to be displaced on-site</li> </ul>	<ul style="list-style-type: none"> <li>Official plan(s)</li> <li>Zoning by-laws</li> <li>City planning staff contact</li> </ul>
	<ul style="list-style-type: none"> <li>Area and designation of land to be disrupted off-site</li> </ul>	<ul style="list-style-type: none"> <li>Official plan(s)</li> <li>Zoning by-laws</li> <li>City planning staff contact</li> </ul>
	<ul style="list-style-type: none"> <li>Change in land use character compared to existing designations</li> </ul>	<ul style="list-style-type: none"> <li>Official plan</li> <li>Zoning by-laws</li> <li>City planning staff contact</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> of heritage or archaeological resources<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Presence of known archaeological resources on-site</li> </ul>	<ul style="list-style-type: none"> <li>Ministry of Culture</li> <li>City staff</li> </ul>
	<ul style="list-style-type: none"> <li>Number of built heritage or cultural landscape features on-site that would be displaced</li> </ul>	<ul style="list-style-type: none"> <li>Historical records</li> <li>City staff</li> </ul>
	<ul style="list-style-type: none"> <li>Number of built heritage or cultural landscape features off-site that might be disrupted</li> </ul>	<ul style="list-style-type: none"> <li>Historical records</li> <li>City staff</li> </ul>

**Table 3.1**  
**ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA**

<b>Criteria Group/Criteria</b>	<b>Indicators</b>	<b>Data Sources</b>
<ul style="list-style-type: none"> <li>Compare potential for impacts to public health and safety (air quality)</li> </ul>	<ul style="list-style-type: none"> <li>Ability to meet provincial regulations</li> </ul>	<ul style="list-style-type: none"> <li>MOE regulations</li> </ul>
<b>Economics</b>		
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> to existing businesses<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Number, type and sensitivity of businesses on-site that would be displaced.</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Site review</li> </ul>
	<ul style="list-style-type: none"> <li>Number, type and sensitivity of businesses off-site that might experience disruption effects during operation</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>Site review</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for displacement or disruption<sup>1</sup> on agriculture/forestry/mining resources<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Area of on-site agriculture/forestry or mining industry resources that would be displaced</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>MNR mapping</li> <li>Site review</li> </ul>
	<ul style="list-style-type: none"> <li>Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation</li> </ul>	<ul style="list-style-type: none"> <li>Topographic and aerial mapping</li> <li>MNR mapping</li> <li>Site review</li> </ul>
<b>Cost</b>		
<ul style="list-style-type: none"> <li>Compare potential lifecycle cost of alternative</li> </ul>	<ul style="list-style-type: none"> <li>Placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high)</li> </ul>	<ul style="list-style-type: none"> <li>Conceptual site designs</li> <li>Historical operating costs</li> </ul>
<b>Technical Considerations</b>		
<ul style="list-style-type: none"> <li>Compare ease of implementation</li> </ul>	<ul style="list-style-type: none"> <li>Ease of site development</li> </ul>	<ul style="list-style-type: none"> <li>Waste density</li> <li>Conceptual site design</li> </ul>
	<ul style="list-style-type: none"> <li>Effects on existing /proposed landfill infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Conceptual site design</li> </ul>
<b>Transportation</b>		
<ul style="list-style-type: none"> <li>Compare potential for affects on airports</li> </ul>	<ul style="list-style-type: none"> <li>Distance from Sault Ste. Marie airport</li> </ul>	<ul style="list-style-type: none"> <li>Topographic mapping</li> </ul>
<ul style="list-style-type: none"> <li>Compare potential for affects on traffic volumes</li> </ul>	<ul style="list-style-type: none"> <li>Annual truck kilometres travelled and character of roadway (i.e. single lane one direction, multi-lane)</li> </ul>	<ul style="list-style-type: none"> <li>Estimated numbers of trucks</li> <li>Topographic mapping</li> </ul>

**Table 3.1**  
**ALTERNATIVE METHODS STEP 2 EVALUATION CRITERIA**

<b>Criteria Group/Criteria</b>	<b>Indicators</b>	<b>Data Sources</b>
	<ul style="list-style-type: none"><li>• Annual number of trucks travelling through intersections</li></ul>	<ul style="list-style-type: none"><li>• Road maps</li><li>• Estimated numbers of trucks</li></ul>
<ul style="list-style-type: none"><li>• Compare potential for impacts of haulage truck traffic on the movement of farm equipment</li></ul>	<ul style="list-style-type: none"><li>• Annual number of trucks travelling through agricultural areas</li></ul>	<ul style="list-style-type: none"><li>• Road maps</li><li>• Estimated numbers of trucks</li></ul>

**Table 4.1 Step 1 - Evaluation of Geometric Expansion Options**  
 (expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

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

<sup>3</sup> Disruption includes consideration of nuisance effects (e.g., dust, noise, odour).

<sup>4</sup> Potential impacts along the access route were removed from the evaluation as all expansion options are within the existing property boundary and would be ranked equally.

**Table 4.1 Step 1 - Evaluation of Geometric Expansion Options**  
 (expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
	area.	new fill area similar for Options 1-3.	new fill area similar for Options 1-3.	new fill area similar for Options 1-3.	potential areas where contingency measures would be required.
<b>Compare potential for effects on surface water resources</b>	• Effect on management of existing site impacts	<b>Ranked First:</b> Option does not effect present mitigation of surface water impacts from the existing site.	<b>Ranked First:</b> Option does not effect present mitigation of surface water impacts from the existing site.	<b>Ranked First:</b> Option does not effect present mitigation of surface water impacts from the existing site.	<b>Ranked Second:</b> Southern fill area may impact management of existing site impacts.
	• Surface water monitoring requirements	<b>Ranked First:</b> No change in surface water monitoring requirements.	<b>Ranked Second:</b> Expansion in the north may require a small change in surface water monitoring requirements.	<b>Ranked Second:</b> Expansion in the north may require a small change in surface water monitoring requirements.	<b>Ranked Third:</b> Southern fill area will increase surface water monitoring requirements.
	• Contingency options for new fill area.	<b>Ranked First:</b> No surface water features in vicinity of western expansion reduces potential need for contingency measures.	<b>Ranked Second:</b> Northern expansion requires consideration of contingency measures for Canon Creek in the north.	<b>Ranked Second:</b> Northern expansion requires consideration of contingency measures for Canon Creek in the north.	<b>Ranked Third:</b> Southern fill area requires contingency measures for the former meander area.
<b>Social-Cultural Environment</b>					
<b>Compare potential for displacement or disruption to residents<sup>4</sup></b>	• Number of residences on-site who would be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no residences will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no residences will be displaced.
	• Number of residences off-site who may experience disruption effects (e.g. noise, dust, odour) during operation.	<b>Ranked First:</b> There are approximately 97 residences within 1 km of the off-site study area.	<b>Ranked First:</b> There are approximately 94 residences within 1 km of the off-site study area.	<b>Ranked First:</b> There are approximately 97 residences within 1 km of the off-site study area.	<b>Ranked Second:</b> There are approximately 95 residences within 1 km of the off-site study area.  Greater potential for disruption effects and visual impact since the southern expansion area is closest to residences.
	• Character of the community in the vicinity of the site and potential for impact on that character	<b>Ranked Equally:</b> All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	<b>Ranked Equally:</b> All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	<b>Ranked Equally:</b> All site expansion options have the same potential to impact the character of the community in the vicinity of the site.	<b>Ranked Equally:</b> All site expansion options have the same potential to impact the character of the community in the vicinity of the site.
<b>Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)<sup>4</sup></b>	• Number and type of community features on-site that would be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no community features will be displaced.	<b>Ranked Equally:</b> All site expansion options are located within the existing property boundary and therefore no community features will be displaced.
	• Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.	<b>Ranked Equally:</b> There are no community features within 1km of the off-site study area.	<b>Ranked Equally:</b> There are no community features within 1km of the off-site study area.	<b>Ranked Equally:</b> There are no community features within 1km of the off-site study area.	<b>Ranked Equally:</b> There are no community features within 1km of the off-site study area.
<b>Compare potential for impact</b>	• Area and designation of land to	<b>Ranked Equally:</b> Requires 16.7 ha for the	<b>Ranked Equally:</b> Requires 17.1 ha for the	<b>Ranked Equally:</b> Requires 20.2 ha for	<b>Ranked Equally:</b> Requires 20 ha for the

**Table 4.1 Step 1 - Evaluation of Geometric Expansion Options**  
*(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)*

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
<b>on future land use plans<sup>4</sup></b>	be displaced on-site	footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	footprint area. The expansion is located within the existing property boundary so there will be no change in land use.
	• Area and designation of land to be disrupted off-site	<b>Ranked First.</b> All site expansion options have the same land use designation (Rural Area Zone).	<b>Ranked First.</b> All site expansion options have the same land use designation (Rural Area Zone).	<b>Ranked First.</b> All site expansion options have the same land use designation (Rural Area Zone).	<b>Ranked Second:</b> All site expansion options have the same land use designation (Rural Area Zone).  Option 4 is closest to an Environmental Management Zone (Root River).
	• Change in land use character compared to existing designations	<b>Ranked Equally.</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	<b>Ranked Equally.</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	<b>Ranked Equally.</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	<b>Ranked Equally.</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.
<b>Compare potential for displacement or disruption of heritage or archaeological resources<sup>4</sup></b>	• Presence of known archaeological resources on-site	<b>Ranked Equally.</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.	<b>Ranked Equally.</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.	<b>Ranked Equally.</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.	<b>Ranked Equally.</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.
	• Number of built heritage or cultural landscape features on-site that would be displaced	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.
	• Number of built heritage or cultural landscape features off-site that might be disrupted	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.	<b>Ranked Equally.</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.
<b>Compare potential for impacts to public health and safety (air quality)</b>	• Ability to meet provincial regulations	<b>Ranked Equally.</b> All options have been designed to meet provincial regulations.	<b>Ranked Equally.</b> All options have been designed to meet provincial regulations.	<b>Ranked Equally.</b> All options have been designed to meet provincial regulations.	<b>Ranked Equally.</b> All options have been designed to meet provincial regulations.
<b>Economics</b>					
<b>Compare potential for displacement or disruption to existing businesses<sup>4</sup></b>	• Number, type and sensitivity of businesses on-site that would be displaced.	<b>Ranked Equally.</b> All site expansion options are located within the existing property boundary and therefore no business will be displaced.	<b>Ranked Equally.</b> All site expansion options are located within the existing property boundary and therefore no business will be displaced.	<b>Ranked Equally.</b> All site expansion options are located within the existing property boundary and therefore no business will be displaced.	<b>Ranked Equally.</b> All site expansion options are located within the existing property boundary and therefore no business will be displaced.

**Table 4.1 Step 1 - Evaluation of Geometric Expansion Options**  
(expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
	<ul style="list-style-type: none"> <li>Number, type and sensitivity of businesses off-site that might experience disruption effects during operation</li> </ul>	<p><b>Ranked First:</b> There are approximately 32 businesses within 1 km of the off-site study area.</p> <p>Staff and clients may experience some disruption effects.</p>	<p><b>Ranked First:</b> There are approximately 31 businesses within 1 km of the off-site study area.</p> <p>Staff and clients may experience some disruption effects.</p>	<p><b>Ranked First:</b> There are approximately 32 businesses within 1 km of the off-site study area.</p> <p>Staff and clients may experience some disruption effects.</p>	<p><b>Ranked Second:</b> There are approximately 31 businesses within 1 km of the off-site study area.</p> <p>Staff and clients may experience some disruption effects.</p> <p>Greater potential for disruption effects and visual impact since the southern expansion area is closest to businesses including a public campground.</p>
Compare potential for displacement or disruption on agriculture / forestry / mining resources <sup>4</sup>	<ul style="list-style-type: none"> <li>Area of on-site agriculture/forestry or mining industry resources that would be displaced</li> </ul>	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.
	<ul style="list-style-type: none"> <li>Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation</li> </ul>	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.
Cost					
Compare potential lifecycle cost of alternative	<ul style="list-style-type: none"> <li>Placement in estimated range of landfill tipping fees for full cost recovery (e.g. low, medium, high)</li> </ul>	<p><b>Ranked First:</b> The estimated range in tipping fees for all Options is \$73 to \$80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.</p> <p>Option 1 is in the low end of the range as it requires the relocation of the public drop off depot, maintenance building, scale house, scales and internal roads but does not require a liner overlapping the existing fill area.</p>	<p><b>Ranked First:</b> The estimated range in tipping fees for all Options is \$73 to \$80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.</p> <p>Option 2 is in the low end of the range and doesn't require any relocation but has an increased area to landfill (compared to Option 1) and placement of a liner over the existing fill area.</p>	<p><b>Ranked Third:</b> The estimated range in tipping fees for all Options is \$73 to \$80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.</p> <p>Option 3 is in the high end of the range as it requires relocation of the same infrastructure in Option 1, a liner installed over the existing fill area and has the greatest area to landfill.</p>	<p><b>Ranked Second:</b> The estimated range in tipping fees for all Options is \$73 to \$80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.</p> <p>Option 4 is in the middle of the range as it requires relocation of the Elementa pilot facility and landfill gas management blower/flare station, requires an increased area to be lined relative to Options 1 and 2 but does not require a liner or drainage layer over the existing waste.</p>
Technical Considerations					
Compare ease of implementation	<ul style="list-style-type: none"> <li>Ease of site development and operation</li> </ul>	<p><b>Ranked Third:</b> Would need to increase waste density by 30% to achieve target disposal capacity.</p> <p>Proposed footprint configuration is easily</p>	<p><b>Ranked Second:</b> Provides the target disposal capacity with current waste density.</p> <p>Footprint configuration is somewhat</p>	<p><b>Ranked First:</b> Provides the target disposal capacity with current waste density.</p> <p>Footprint configuration is enhanced</p>	<p><b>Ranked Fourth:</b> Would need to increase waste density by 30% to achieve target disposal capacity.</p> <p>Proposed footprint configuration is easily</p>

**Table 4.1 Step 1 - Evaluation of Geometric Expansion Options**  
 (expansion options are ranked from most preferred (First) to least preferred (Fourth), where applicable)

Criteria Group/Criteria	Indicators	Option 1 - West Expansion	Option 2 – West and North Expansion A	Option 3 – West and North Expansion B	Option 4 – West and South Expansion
		developed.  All options have a surplus of soil for cover needs.  The average depth of west expansion is 18 m.	awkward with development challenges including storm water management in vicinity of existing public drop-off area  All options have a surplus of soil for cover needs.  The average depth of west expansion is 18 m.	relative to option 2.  All options have a surplus of soil for cover needs.  The average depth of west expansion is 11 m. A shallower excavation depth will be easier for operators to develop the fill area.	developed.  Although a 100 m buffer has been assumed, more intense operational controls may be required due to the proximity to Fifth Line East.  All options have a surplus of soil for cover needs.  The average depth of west expansion is 18 m.
	• Effects on existing / proposed landfill infrastructure	<b>Ranked Third:</b> Most notably would require relocation of public drop off area, scales, scale house and maintenance building.	<b>Ranked First:</b> No relocation of principle facilities would be required.	<b>Ranked Third:</b> Most notably would require relocation of public drop off area, scales, scale house and maintenance building.	<b>Ranked Second:</b> Most notably would require relocation of the Elementa facility and blower/flare station.
<b>Transportation</b>					
<b>Compare potential for affects on airports</b>	• Distance from Sault Ste. Marie airport	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).
<b>Compare potential for affects on traffic volumes<sup>5</sup></b>	• Annual truck kilometres travelled and character of roadway (i.e. single lane one direction, multi-lane)	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.
	• Annual number of trucks travelling through intersections	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.
<b>Compare potential for impacts of haulage truck traffic on the movement of farm equipment<sup>5</sup></b>	• Annual number of trucks travelling through agricultural areas	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	<b>Ranked Equally:</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.

<sup>5</sup> The waste haul route for this criterion includes public roads from the main waste generation points to each site alternative.

Step 1 in the evaluation revealed that Option 3 is the preferred geometric expansion option. Step 2 considers the advantages and disadvantages of adding a landfill mining component within the western portion of the existing disposal footprint. The initial evaluation of Option 3 with and without a landfill mining component is presented in Table 4.2

<b>Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining</b> ( <i>expansion options are ranked from most preferred (First) to least preferred (Second), where applicable</i> )			
<b>Criteria Group/Criteria</b>	<b>Indicators</b>	<b>Option 3 – West and North Expansion B</b>	<b>Option 3 with Landfill Mining</b>
<b>Natural Environment</b>			
<b>Compare potential for displacement or disruption<sup>6</sup> of terrestrial features<sup>7</sup></b>	<ul style="list-style-type: none"> <li>Area and significance of terrestrial features on site that would be displaced</li> </ul>	<p><b>Ranked Equally.</b> Requires 20.2 ha for footprint area and displaces 7.7 ha of forested area.</p> <p>These lands are within the existing landfill site boundary and are not identified as significant forests.</p>	<p><b>Ranked Equally.</b> Requires 20.1 ha for footprint area and displaces 7.7 ha of forested area.</p> <p>These lands are within the existing landfill site boundary and are not identified as significant forests.</p>
	<ul style="list-style-type: none"> <li>Area and significance of terrestrial features off-site that may experience disruption effects during operation.</li> </ul>	<p><b>Ranked Equally.</b> Both options have the same potential for disruption impacts off-site.</p>	<p><b>Ranked Equally.</b> Both options have the same potential for disruption impacts off-site.</p>
<b>Compare potential for displacement or disruption of aquatic features<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Amount and significance of aquatic habitat on-site that would be displaced or disrupted</li> </ul>	<p><b>Ranked Equally.</b> Both options are not expected to change the impact to Canon Creek or Root River. There are no other aquatic features on-site.</p>	<p><b>Ranked Equally.</b> Both options are not expected to change the impact to Cannon Creek or Root River. There are no other aquatic features on-site.</p>
	<ul style="list-style-type: none"> <li>Amount and significance of aquatic habitat off-site that may be disrupted during operation</li> </ul>	<p><b>Ranked Equally.</b> Low potential for disruption of downstream aquatic habitat</p>	<p><b>Ranked Equally.</b> Low potential for disruption of downstream aquatic habitat</p>

<sup>6</sup> Disruption includes consideration of nuisance effects (e.g., dust, noise, odour).

<sup>7</sup> Potential impacts along the access route were removed from the evaluation as all expansion options are within the existing property boundary and would be ranked equally.

**Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining**  
 (expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
<b>Compare potential for effects on groundwater resources</b>	<ul style="list-style-type: none"> <li>Effect on management of existing site impacts</li> </ul>	<b>Ranked Second:</b> Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts.	<b>Ranked First:</b> Option makes possible construction of a horizontal collection system to further mitigate existing site impacts near the western property boundary. Vertical expansion with liner on top of existing fill may reduce possibility of increasing existing fill impacts.  Landfill mining of existing fill and installation of a liner allows for further mitigation / reduction of existing site impacts.
	<ul style="list-style-type: none"> <li>Groundwater monitoring requirements</li> </ul>	<b>Ranked Equally:</b> Groundwater monitoring requirements similar for both options.	<b>Ranked Equally:</b> Groundwater monitoring requirements similar for both options.
	<ul style="list-style-type: none"> <li>Contingency options for new fill area.</li> </ul>	<b>Ranked Equally:</b> Contingency options for new fill area similar for both options.	<b>Ranked Equally:</b> Contingency options for new fill area similar for both options.
<b>Compare potential for effects on surface water resources</b>	<ul style="list-style-type: none"> <li>Effect on management of existing site impacts</li> </ul>	<b>Ranked Equally:</b> Option does not effect present mitigation of surface water impacts from the existing site.	<b>Ranked Equally:</b> Option does not effect present mitigation of surface water impacts from the existing site.
	<ul style="list-style-type: none"> <li>Surface water monitoring requirements</li> </ul>	<b>Ranked Equally:</b> Expansion in the north may require a small change in surface water monitoring requirements.	<b>Ranked Equally:</b> Expansion in the north may require a small change in surface water monitoring requirements.
	<ul style="list-style-type: none"> <li>Contingency options for new fill area.</li> </ul>	<b>Ranked Equally:</b> Northern expansion requires consideration of contingency measures for Canon Creek in the north.	<b>Ranked Equally:</b> Northern expansion requires consideration of contingency measures for Canon Creek in north.
<b>Social-Cultural Environment</b>			
<b>Compare potential for displacement or disruption to residents<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Number of residences on-site who would be displaced.</li> </ul>	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no residences will be displaced.	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no residences will be displaced.
	<ul style="list-style-type: none"> <li>Number of residences off-site who may experience disruption effects</li> </ul>	<b>Ranked First:</b> There are 97 residences within 1 km of the off-site study area.	<b>Ranked Second:</b> There are 97 residences within 1 km of the off-site study area.

<b>Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining</b> (expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)			
<b>Criteria Group/Criteria</b>	<b>Indicators</b>	<b>Option 3 – West and North Expansion B</b>	<b>Option 3 with Landfill Mining</b>
	(e.g. noise, dust, odour) during operation.		Neighbouring residents may experience odour effects due to landfill mining. The mining operation is expected to continue for a couple of years.
	<ul style="list-style-type: none"> <li>Character of the community in the vicinity of the site and potential for impact on that character</li> </ul>	<b>Ranked Equally:</b> Both options have the same potential to impact the character of the community in the vicinity of the site.	<b>Ranked Equally:</b> Both options have the same potential to impact the character of the community in the vicinity of the site.
<b>Compare potential for displacement or disruption to community features (e.g. parks, recreational facilities)<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Number and type of community features on-site that would be displaced.</li> </ul>	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no community features will be displaced.	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no community features will be displaced.
	<ul style="list-style-type: none"> <li>Number and type of community features off-site that may experience disruption effects (e.g. noise, dust, odour) during operation.</li> </ul>	<b>Ranked Equally:</b> There are no community features within 1 km of the off-site study area.	<b>Ranked Equally:</b> There are no community features within 1 km of the off-site study area.
<b>Compare potential for impact on future land use plans<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Area and designation of land to be displaced on-site</li> </ul>	<b>Ranked Equally:</b> Requires 20.2 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.	<b>Ranked Equally:</b> Requires 20.2 ha for the footprint area. The expansion is located within the existing property boundary so there will be no change in land use.
	<ul style="list-style-type: none"> <li>Area and designation of land to be disrupted off-site</li> </ul>	<b>Ranked Equally:</b> All site expansion options have the same land use designation (Rural Area Zone).	<b>Ranked Equally:</b> All site expansion options have the same land use designation (Rural Area Zone).
	<ul style="list-style-type: none"> <li>Change in land use character compared to existing designations</li> </ul>	<b>Ranked Equally:</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.	<b>Ranked Equally:</b> The footprints for all site expansion options are within the existing property boundary and therefore no change in land use character is anticipated.
<b>Compare potential for displacement or disruption of heritage or archaeological resources<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Presence of known archaeological resources on-site</li> </ul>	<b>Ranked Equally:</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.	<b>Ranked Equally:</b> All site expansion options are located on the same site where there are no known archaeological resources on-site.

**Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining**  
 (expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
	<ul style="list-style-type: none"> <li>Number of built heritage or cultural landscape features on-site that would be displaced</li> </ul>	<b>Ranked Equally:</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.	<b>Ranked Equally:</b> There are no built heritage or cultural landscape features on-site that would be displaced for all site expansion options.
	<ul style="list-style-type: none"> <li>Number of built heritage or cultural landscape features off-site that might be disrupted</li> </ul>	<b>Ranked Equally:</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.	<b>Ranked Equally:</b> There are no built heritage or cultural landscape features within 1 km of the off-site study area.
<b>Compare potential for impacts to public health and safety (air quality)</b>	<ul style="list-style-type: none"> <li>Ability to meet provincial regulations</li> </ul>	<b>Ranked First:</b> All options have been designed to meet provincial regulations.	<b>Ranked Second:</b> All options have been designed to meet provincial regulations.  Additional mitigation measures may be required to address concerns as a result of landfill mining. Based on other landfill mining work in Ontario, concerns can likely be mitigated.
<b>Economics</b>			
<b>Compare potential for displacement or disruption to existing businesses<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Number, type and sensitivity of businesses on-site that would be displaced.</li> </ul>	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no business will be displaced.	<b>Ranked Equally:</b> Both options are located within the existing property boundary and therefore no business will be displaced.
	<ul style="list-style-type: none"> <li>Number, type and sensitivity of businesses off-site that might experience disruption effects during operation</li> </ul>	<b>Ranked First:</b> There are 32 businesses within 1 km of the off-site study area.  Staff and clients may experience some disruption effects.	<b>Ranked Second:</b> There are 32 businesses within 1 km of the off-site study area.  Staff and clients may experience some disruption effects including increased odour effects due to landfill mining.
<b>Compare potential for displacement or disruption on agriculture / forestry / mining resources<sup>4</sup></b>	<ul style="list-style-type: none"> <li>Area of on-site agriculture/forestry or mining industry resources that would be displaced</li> </ul>	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.	<b>Ranked Equally:</b> There are no agricultural/forestry or mining industry resources on-site and therefore no displacement for all site expansion options.
	<ul style="list-style-type: none"> <li>Area of off-site agriculture/forestry or mining industry resources that might experience disruption effects during operation</li> </ul>	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.	<b>Ranked Equally:</b> There are sand and gravel resources located off-site. The expansion activities are not expected to affect the resource.
<b>Cost</b>			

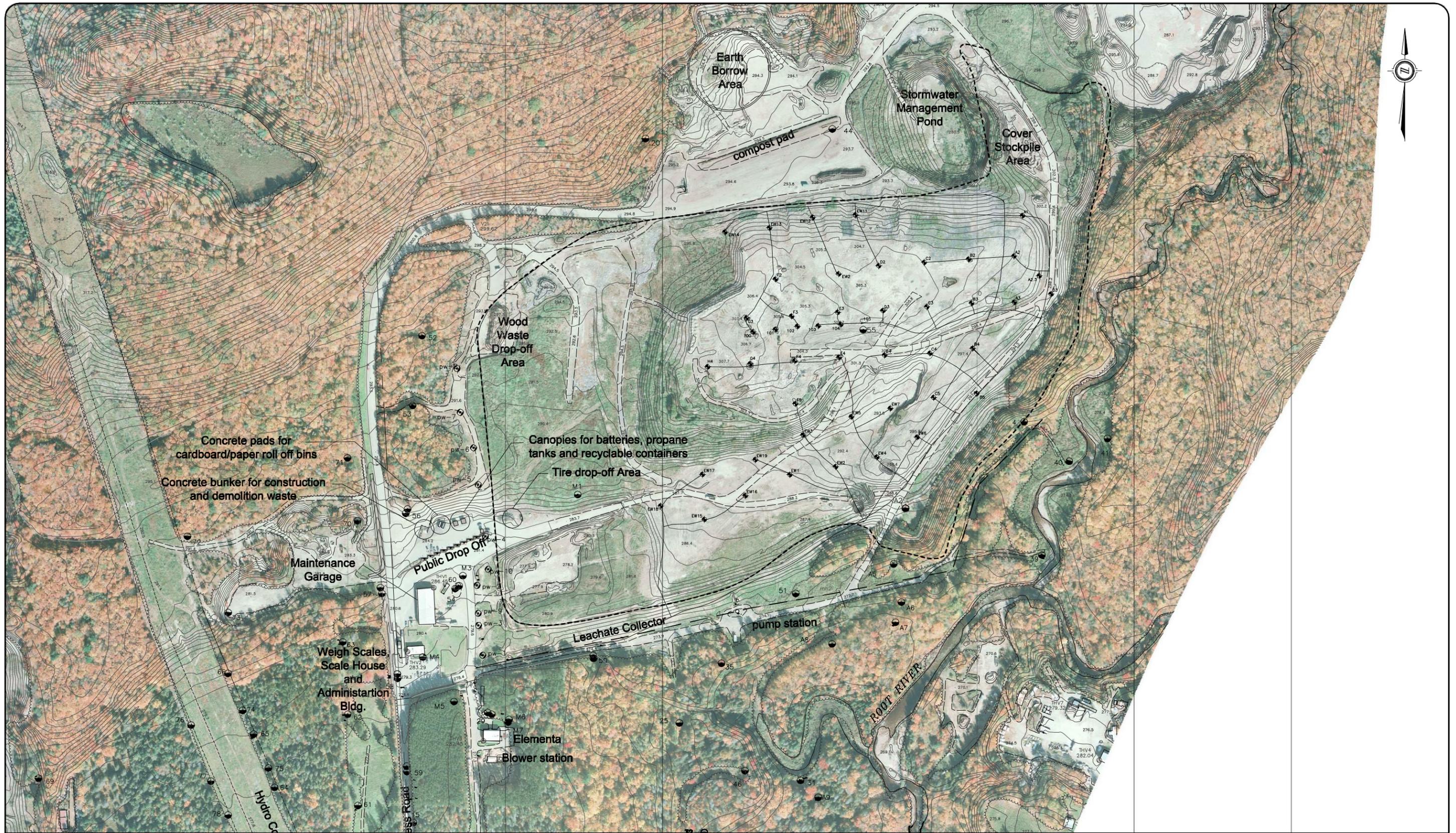
**Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining**  
 (expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
<b>Compare potential lifecycle cost of alternative</b>	<ul style="list-style-type: none"> <li>Estimated lifecycle cost</li> </ul>	<b>Ranked First:</b> The estimated tipping fee for this Option is \$80 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.	<b>Ranked Second:</b> The estimated tipping fee for this Option is \$88 (2012 dollars) per tonne of waste landfilled. The tipping fee will escalate with inflation in the future.  Landfill mining increases the area to be lined and will require purchase of additional equipment and require additional mitigation measures and therefore will be higher than Option 3.
<b>Technical Considerations</b>			
<b>Compare ease of implementation</b>	<ul style="list-style-type: none"> <li>Ease of site and development operation</li> <li>Effects on existing / proposed landfill infrastructure</li> </ul>	<p><b>Ranked First:</b> Provides the target disposal capacity with current waste density.</p> <p>All options have a surplus of soil for cover needs.</p> <p>The average depth of west expansion is 11 m.</p> <p><b>Ranked Equally:</b> Most notably would require relocation of public drop off area, scales and scale house and maintenance building.</p>	<p><b>Ranked Second:</b> Provides the target disposal capacity.</p> <p>Will require ongoing odour mitigation during landfill mining activities.</p> <p>All options have a surplus of soil for cover needs.</p> <p>The average depth of west expansion is 11 m.</p> <p><b>Ranked Equally:</b> Most notably would require relocation of public drop off area, scales and scale house and maintenance building.</p>
<b>Transportation</b>			
<b>Compare potential for affects on airports</b>	<ul style="list-style-type: none"> <li>Distance from Sault Ste. Marie airport</li> </ul>	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).	<b>Ranked Equally:</b> Transport Canada recommends that waste disposal sites be located beyond a 15 km radius from airports to reduce the risk of bird strikes. All site expansion options are located beyond this radius (25 km).
<b>Compare potential for affects on traffic volumes<sup>8</sup></b>	<ul style="list-style-type: none"> <li>Annual truck kilometres travelled and character of</li> </ul>	<b>Ranked Equally:</b> All site expansion options use the same haul route and will	<b>Ranked Equally:</b> All site expansion options use the same haul route and will

<sup>8</sup> The waste haul route for this criterion includes public roads from the main waste generation points to each site alternative.

**Table 4.2 Step 2 - Evaluation of Preferred Geometric Expansion Option with and without Landfill Mining**  
 (expansion options are ranked from most preferred (First) to least preferred (Second), where applicable)

Criteria Group/Criteria	Indicators	Option 3 – West and North Expansion B	Option 3 with Landfill Mining
	roadway (i.e. single lane one direction, multi-lane)  • Annual number of trucks travelling through intersections	manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.  <b>Ranked Equally.</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.	manage the same quantity of waste and therefore the truck kilometres travelled will be the same for all options.  <b>Ranked Equally.</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the intersections traversed will be the same for all options.
<b>Compare potential for impacts of haulage truck traffic on the movement of farm equipment<sup>5</sup></b>	• Annual number of trucks travelling through agricultural areas	<b>Ranked Equally.</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.	<b>Ranked Equally.</b> All site expansion options use the same haul route and will manage the same quantity of waste and therefore the impact of trucks travelling through agricultural areas will be the same for all options.



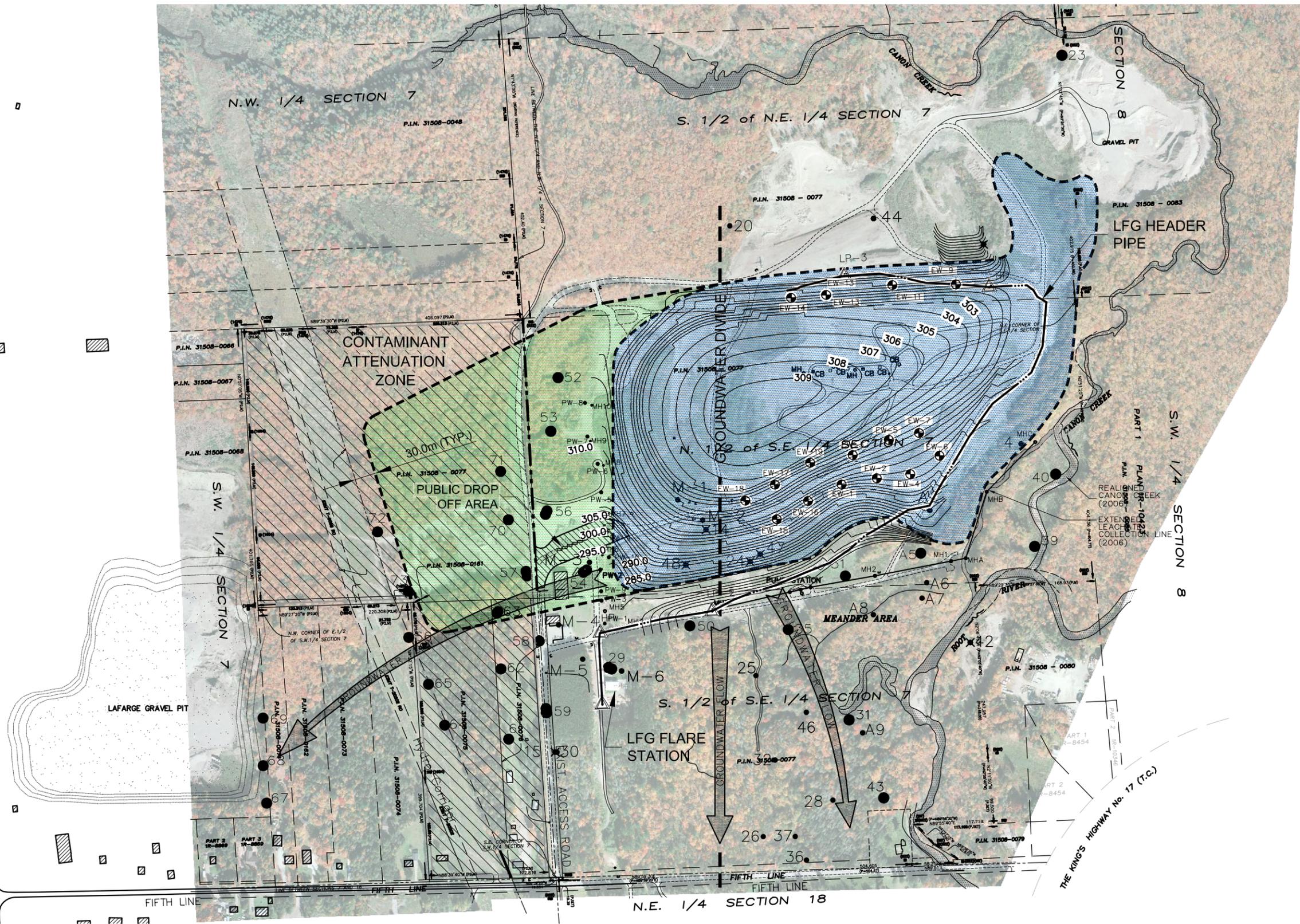
**AECOM**  
 AECOM Canada Ltd.  
 523 Wellington Street East, Sault Ste. Marie Ontario, Canada  
 P6A2M4 T705.942.2612 F705.942.3642

**Legend:**

- Purge Wells
- Methane Gas Monitor
- Monitoring Well and Id Number
- Landfill gas wells and Piping
- Leachate Collector
- Internal Road Network

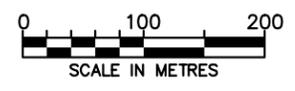
**Note: Aerial photo taken Oct 4, 2010**

Sault Ste. Marie Municipal Landfill Site		Figure No. <b>1</b>
SITE PLAN		
Proj. Manager: — RT	Drawn By: JT	
Scale: 1:4000	Checked By: RT	
Date Issued: — Feb, 2012	Project No: 60395	
Location: figure 1siteplan.dwg	File Name: G:\60395 —	



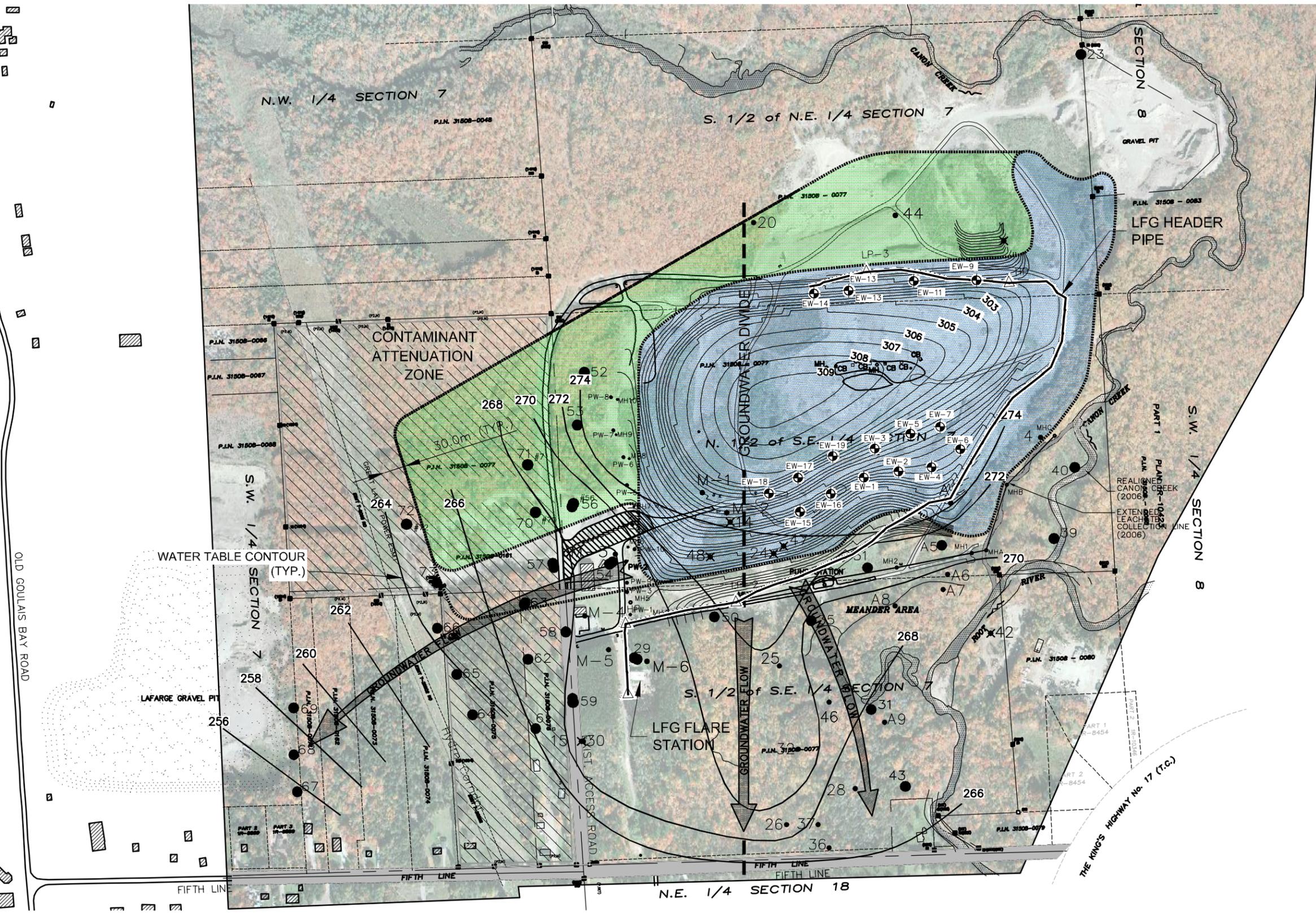
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- 24 MONITORING WELL THAT NO LONGER EXISTS
  - 52 MONITORING WELL NOT SAMPLED IN 2007
  - PW 3 PUMPING WELL
  - MH 3 LEACHATE COLLECTION SYSTEM
  - PROPERTY BOUNDARY
  - LIMIT OF FILL
  - 40 MONITORING WELL SAMPLED IN 2007
  - M-1 METHANE GAS MONITOR

- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BUILDING/RESIDENCE
- LFG EXTRACTION WELL
- SURFACE WATER CONTROL DITCH
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL



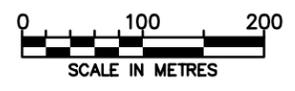
Sault Ste. Marie Municipal Landfill Site  
**OPTION 1  
 WEST EXPANSION**

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>2</b>
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Date Issued: NOV. 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: Option-1.dwg	



- Legend:**
- ✕ 24 MONITORING WELL THAT NO LONGER EXISTS
  - 52 MONITORING WELL NOT SAMPLED IN 2007
  - PW 3 PUMPING WELL
  - MH 3 LEACHATE COLLECTION SYSTEM
  - PROPERTY BOUNDARY
  - LIMIT OF FILL
  - 40 MONITORING WELL SAMPLED IN 2007
  - M-1 METHANE GAS MONITOR

- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BUILDING/RESIDENCE
- LFG EXTRACTION WELL
- SURFACE WATER CONTROL DITCH
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL



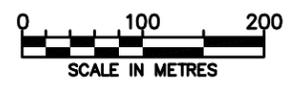
Sault Ste. Marie Municipal Landfill Site  
**OPTION 2**  
 WEST AND NORTH EXPANSION A

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



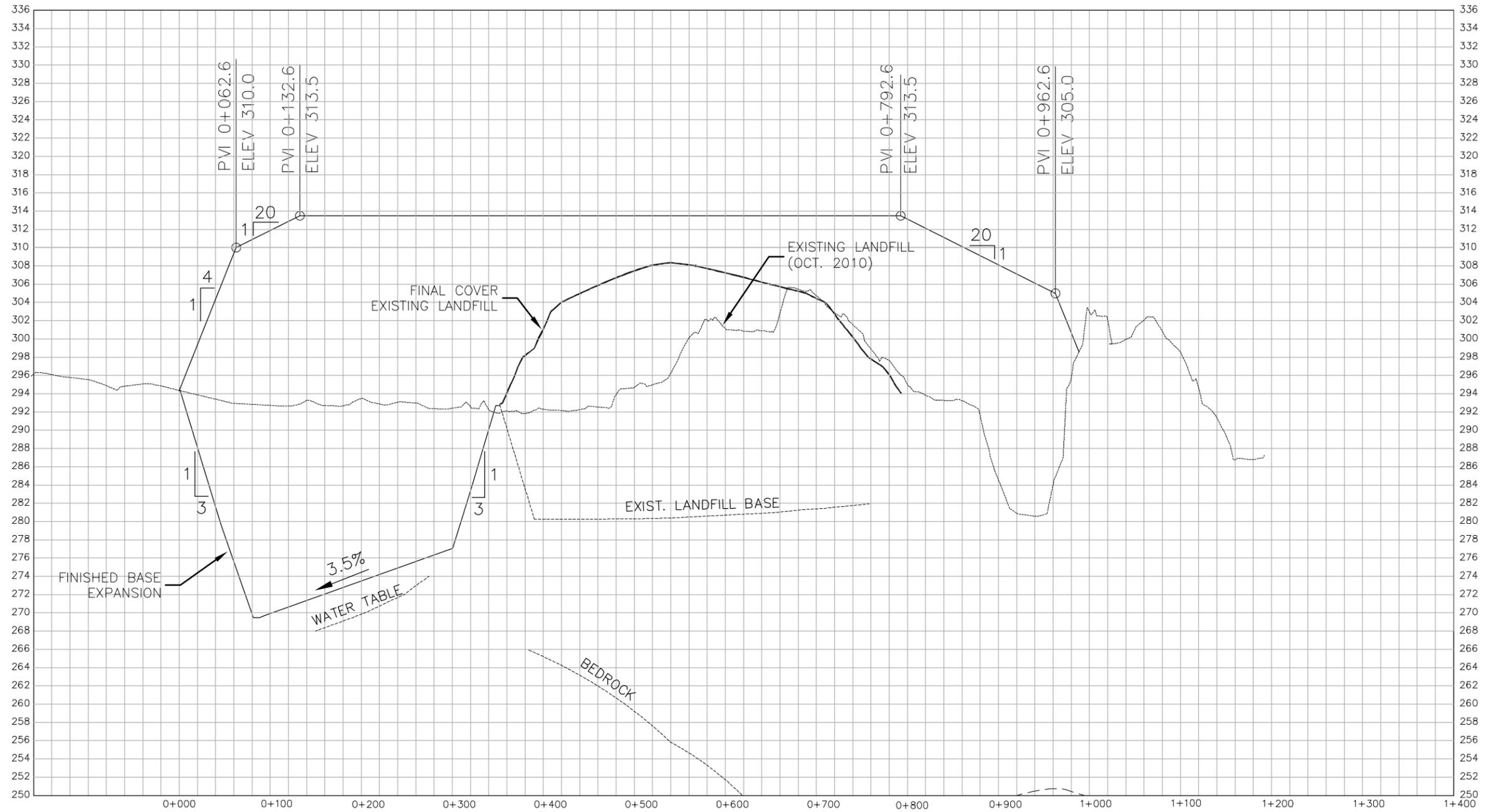
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  - 52 MONITORING WELL NOT SAMPLED IN 2007
  - PW 3 PUMPING WELL
  - MH 3 LEACHATE COLLECTION SYSTEM
  - PROPERTY BOUNDARY
  - LIMIT OF FILL
  - 40 MONITORING WELL SAMPLED IN 2007
  - M-1 METHANE GAS MONITOR

- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BUILDING/RESIDENCE
- LFG EXTRACTION WELL
- SURFACE WATER CONTROL DITCH
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL



Sault Ste. Marie Municipal Landfill Site  
**OPTION 2**  
 WEST AND NORTH EXPANSION A

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.1</b>
Scale: 1 : 6000	Checked By: FRG	
Date Issued: NOV 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	



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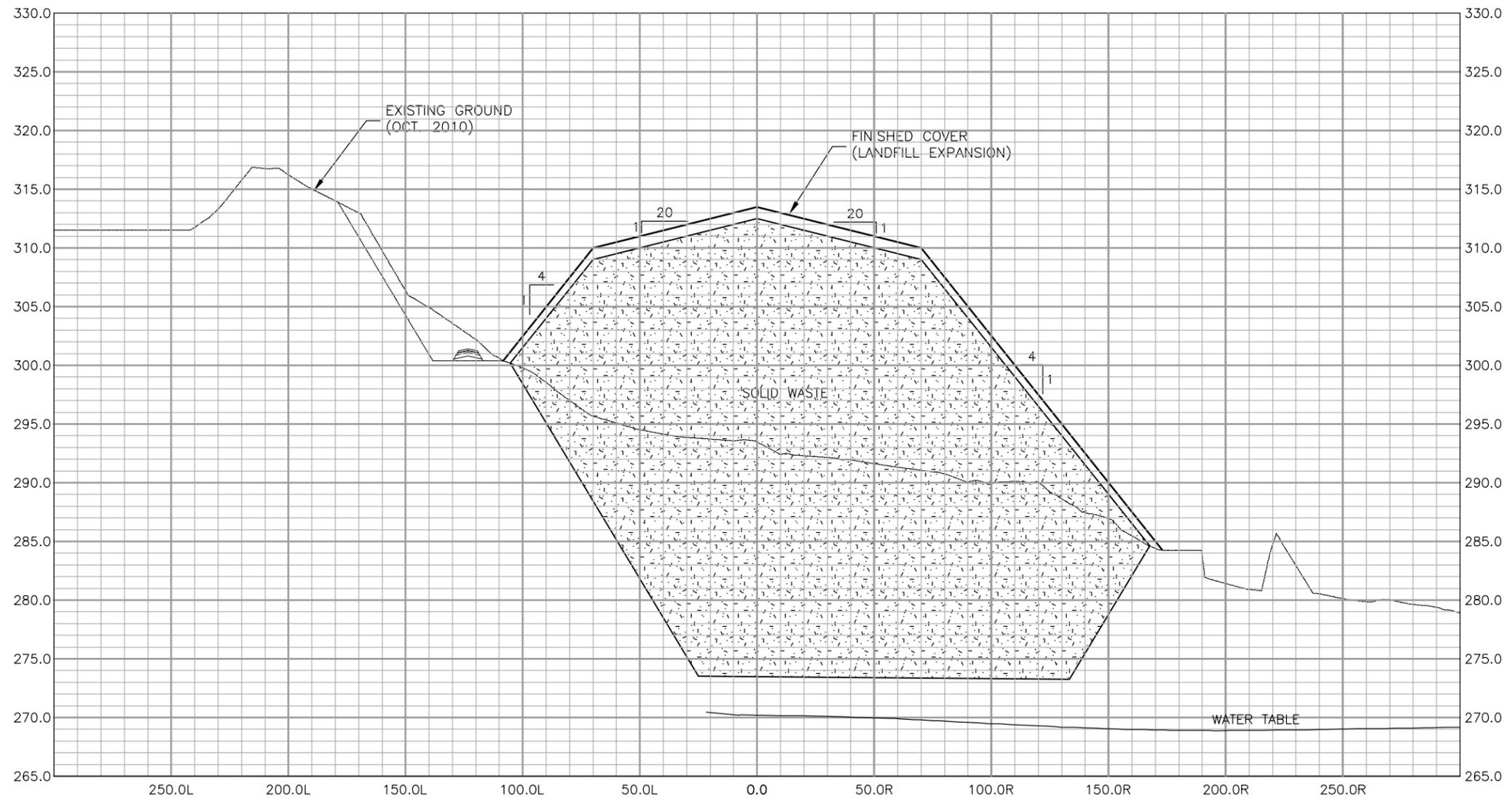


Legend:

Sault Ste. Marie Municipal Landfill Site  
 OPTION 2  
 WEST AND NORTH EXPANSION A  
 SECTION A-A

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.2</b>
Scale: NTS	Checked By: FRG	
Date Issued: JUNE 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	

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SECTION B-B  
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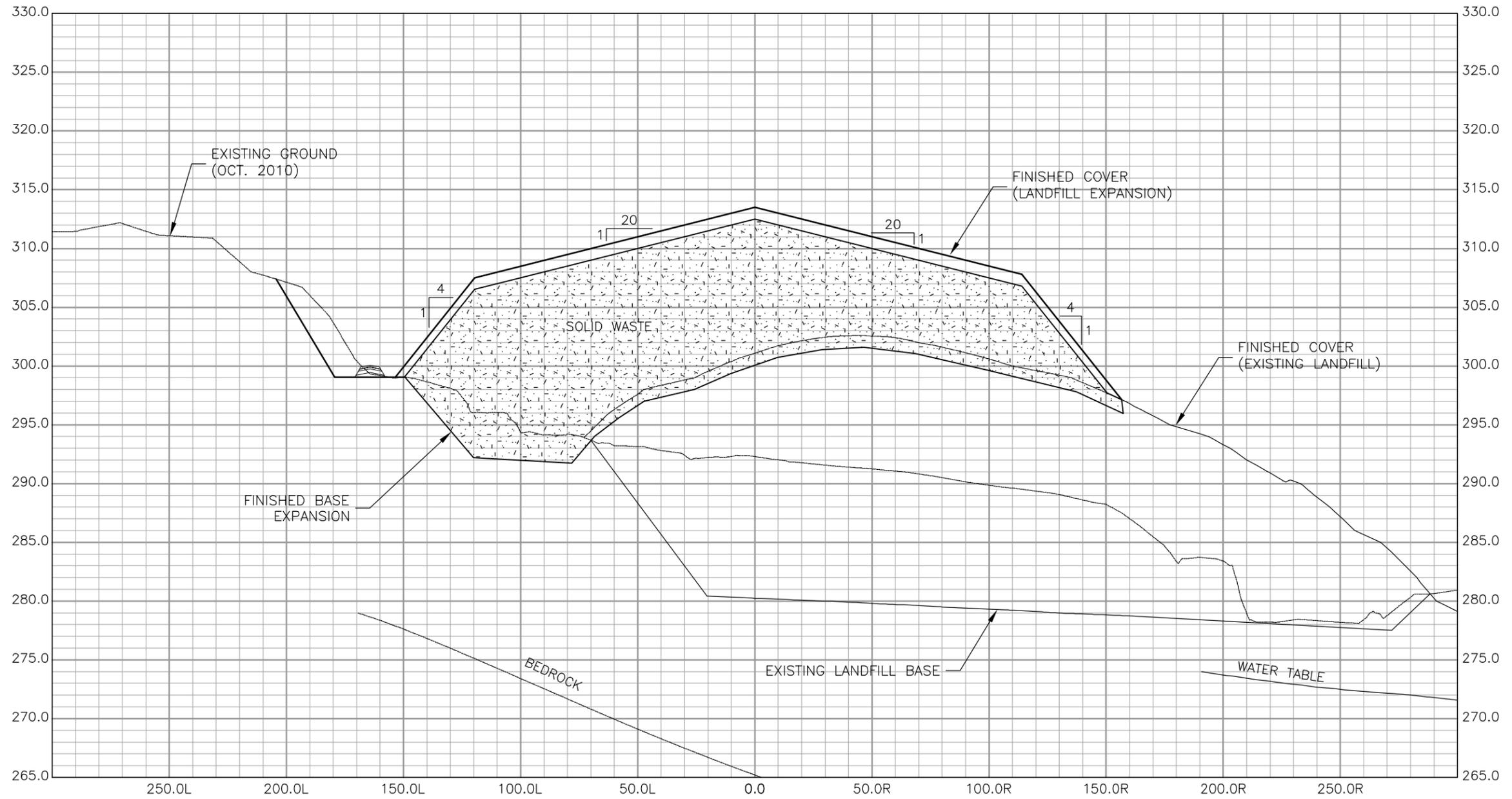


Legend:

Sault Ste. Marie Municipal Landfill Site  
OPTION 2  
WEST AND NORTH EXPANSION A  
SECTION B-B

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.3</b>
Scale: NTS	Checked By: FRG	
Date Issued: JUNE 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	

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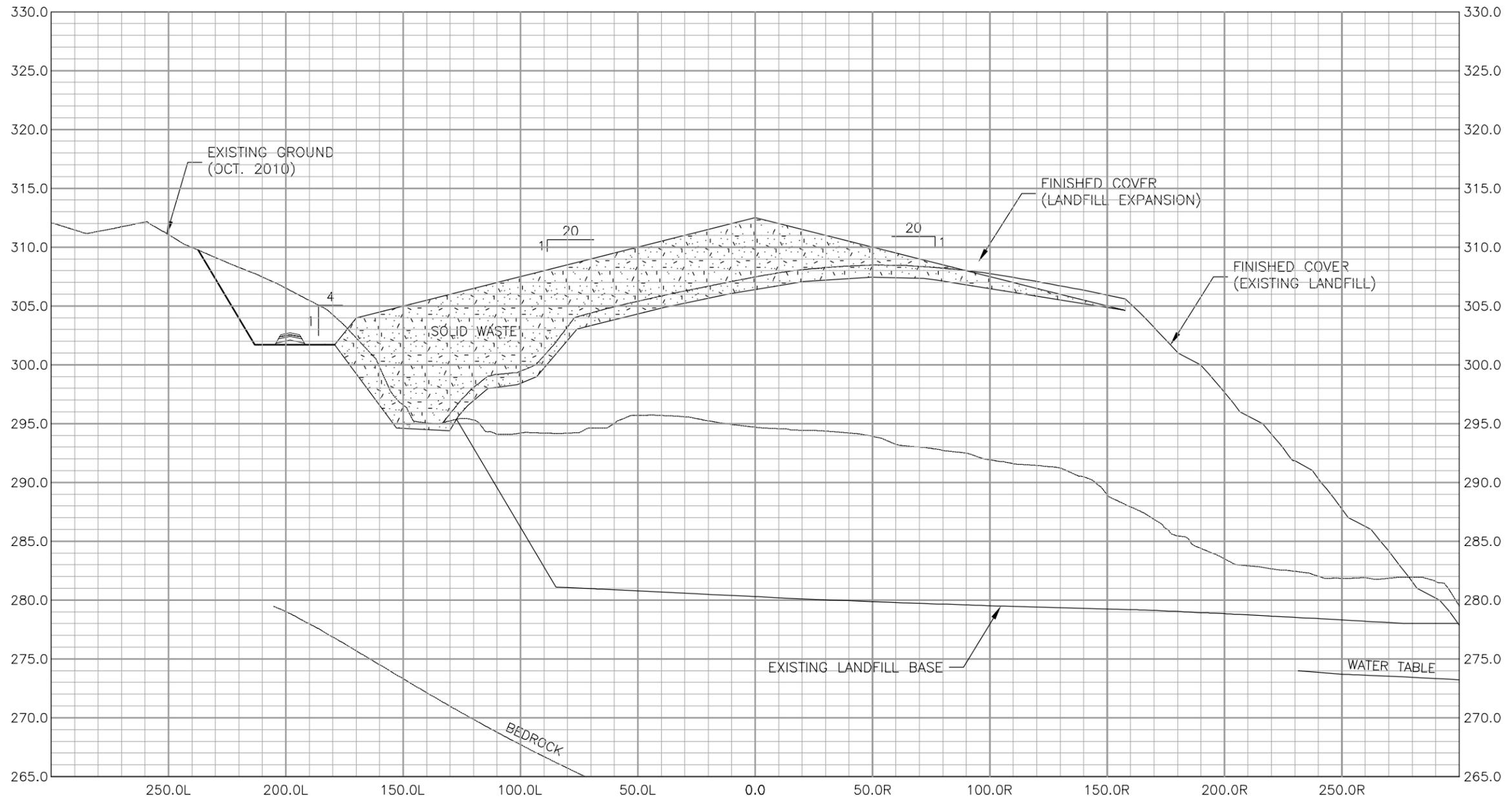
SECTION C-C  
(0+400)



Legend:

Sault Ste. Marie Municipal Landfill Site  
 OPTION 2  
 WEST AND NORTH EXPANSION A  
 SECTION C-C

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.4</b>
Scale: NTS	Checked By: FRG	
Date Issued: JUNE 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	



SECTION D-D  
(0+500)

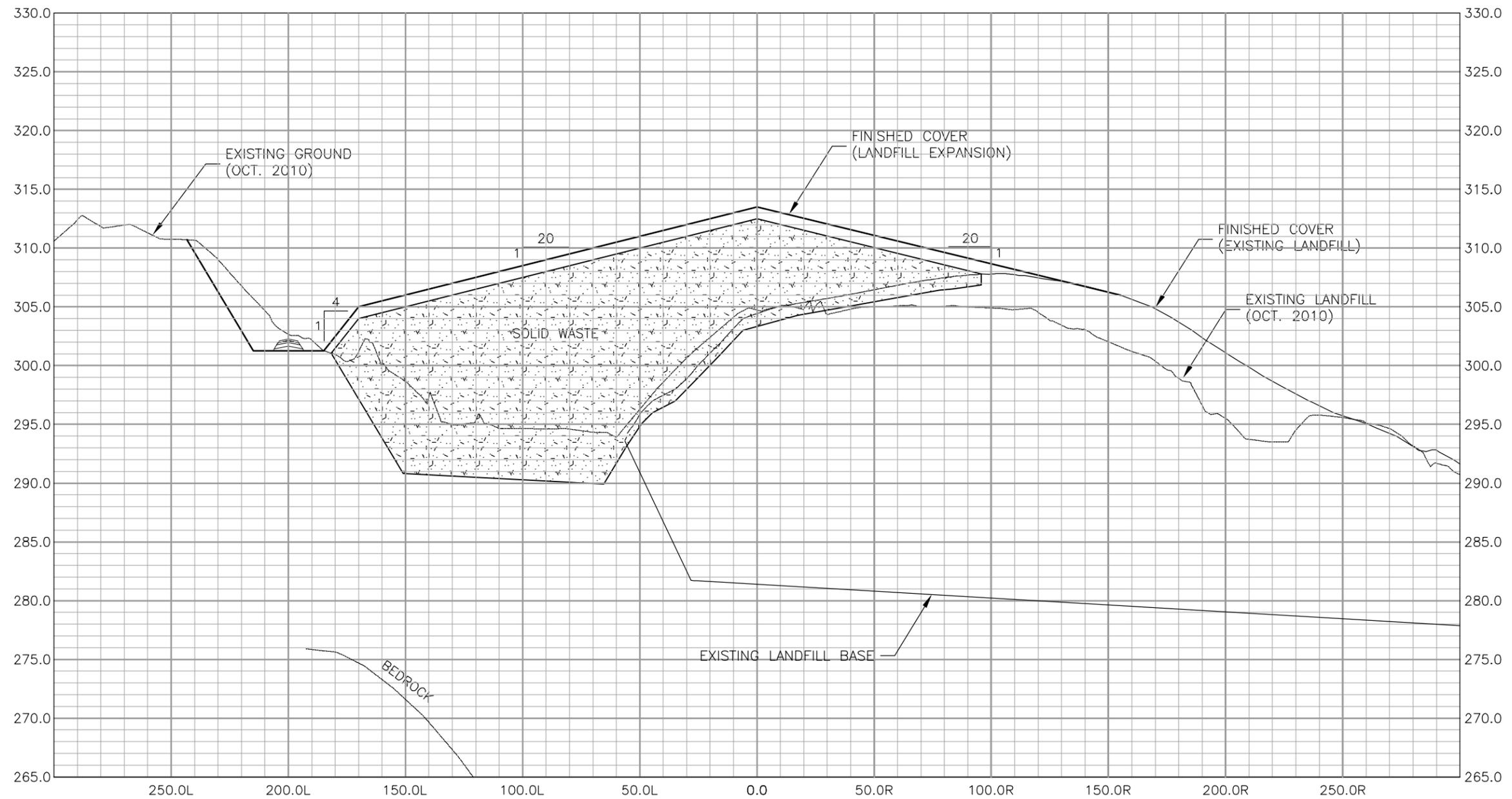
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Legend:

Sault Ste. Marie Municipal Landfill Site  
OPTION 2  
WEST AND NORTH EXPANSION A  
SECTION D-D

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.5</b>
Scale: NTS	Checked By: FRG	
Date Issued: JUNE 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	



SECTION E-E  
(0+700)

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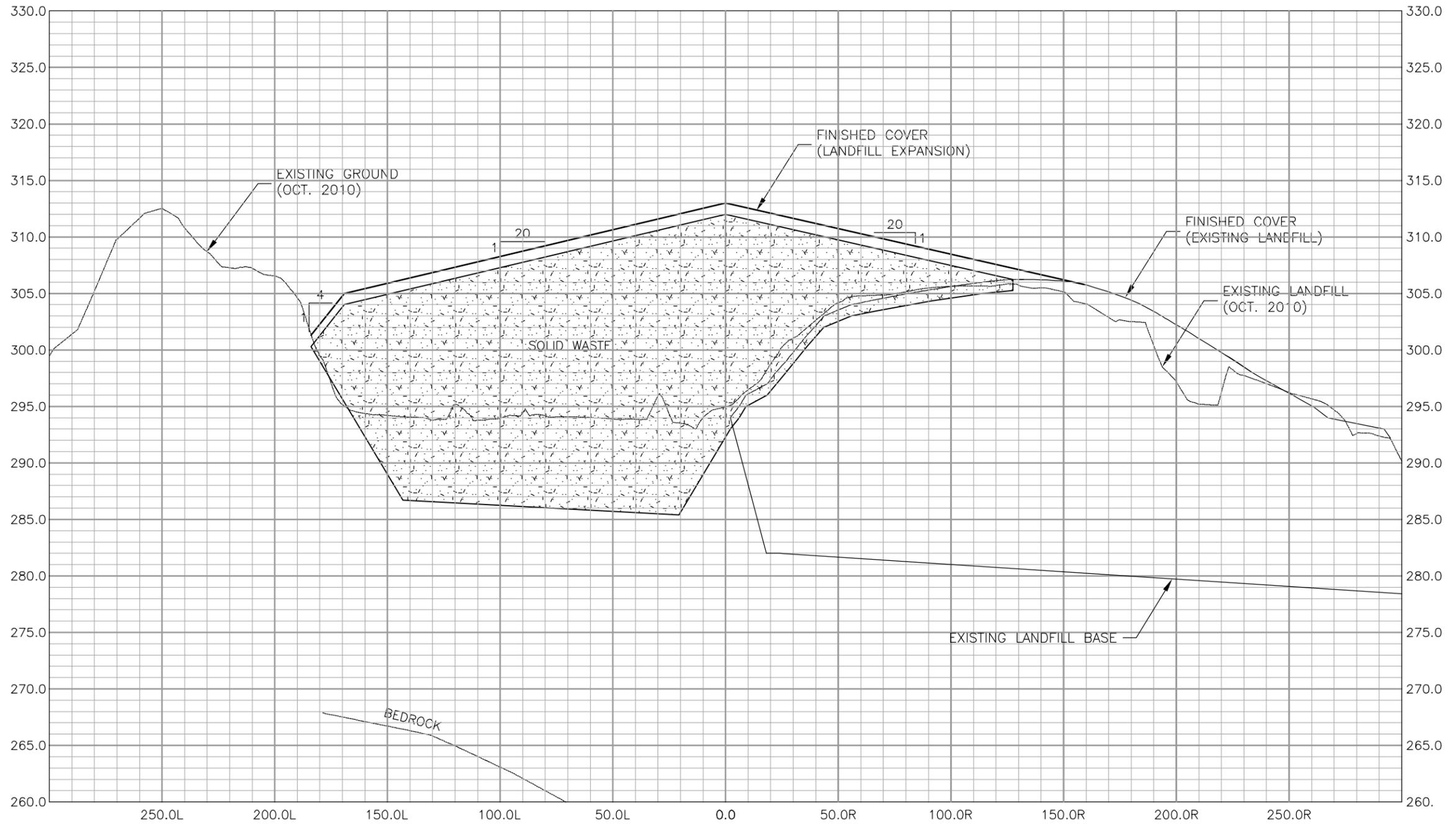


Legend:

Sault Ste. Marie Municipal Landfill Site  
OPTION 2  
WEST AND NORTH EXPANSION A  
SECTION E-E

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.6</b>
Scale: NTS	Checked By: FRG	
Date Issued: JUNE 2011	Project No: 06-6988	
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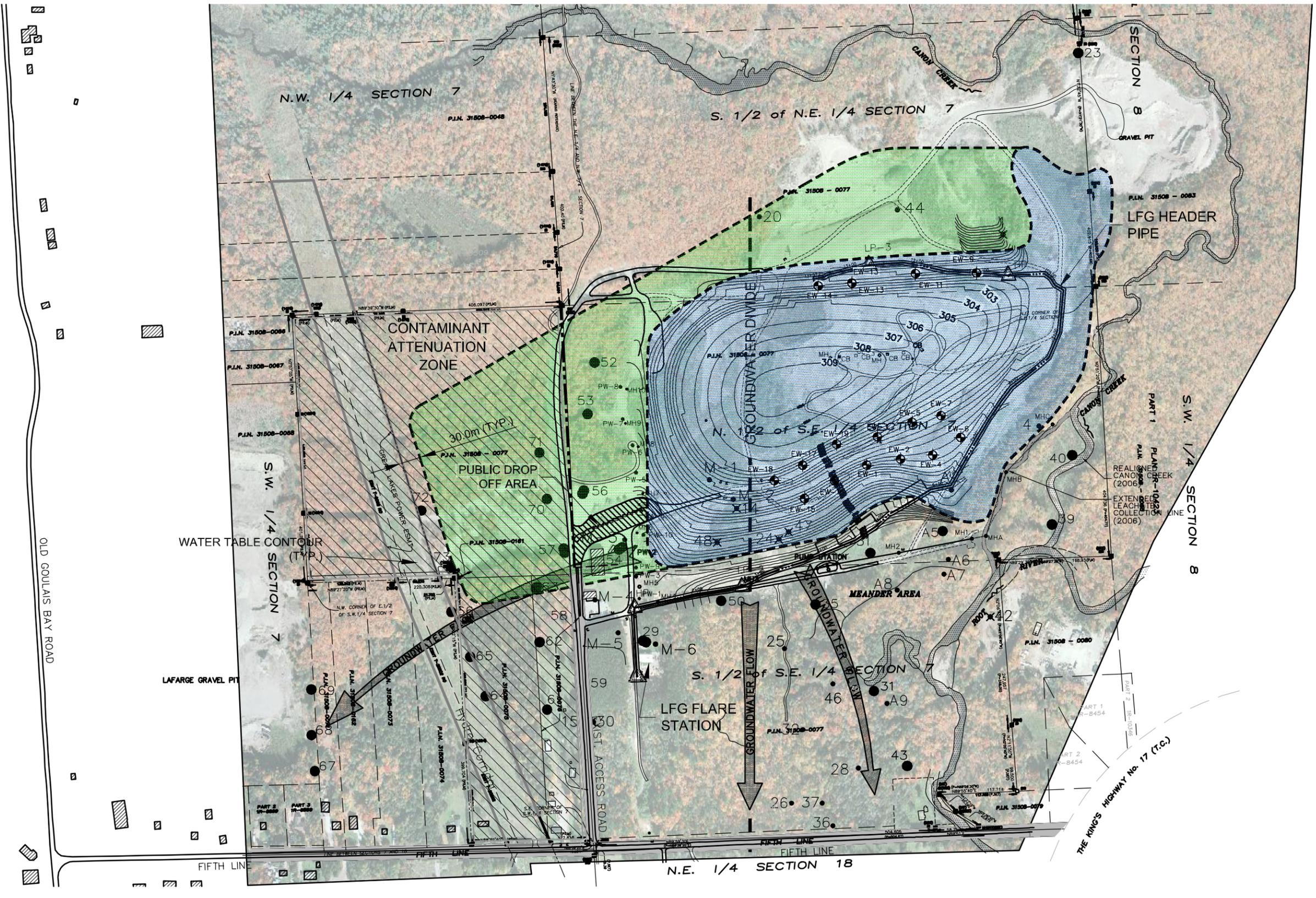
SECTION F-F  
(0+800)



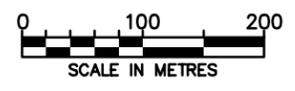
Legend:

Sault Ste. Marie Municipal Landfill Site  
OPTION 2  
WEST AND NORTH EXPANSION A  
SECTION F-F

Proj. Manager: KK	Drawn By: SKB	Figure No. <b>3.7</b>
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Date Issued: JUNE 2011	Project No: 06-6988	
Location: G:\CAD\066988	File Name: OPTION-3.dwg	

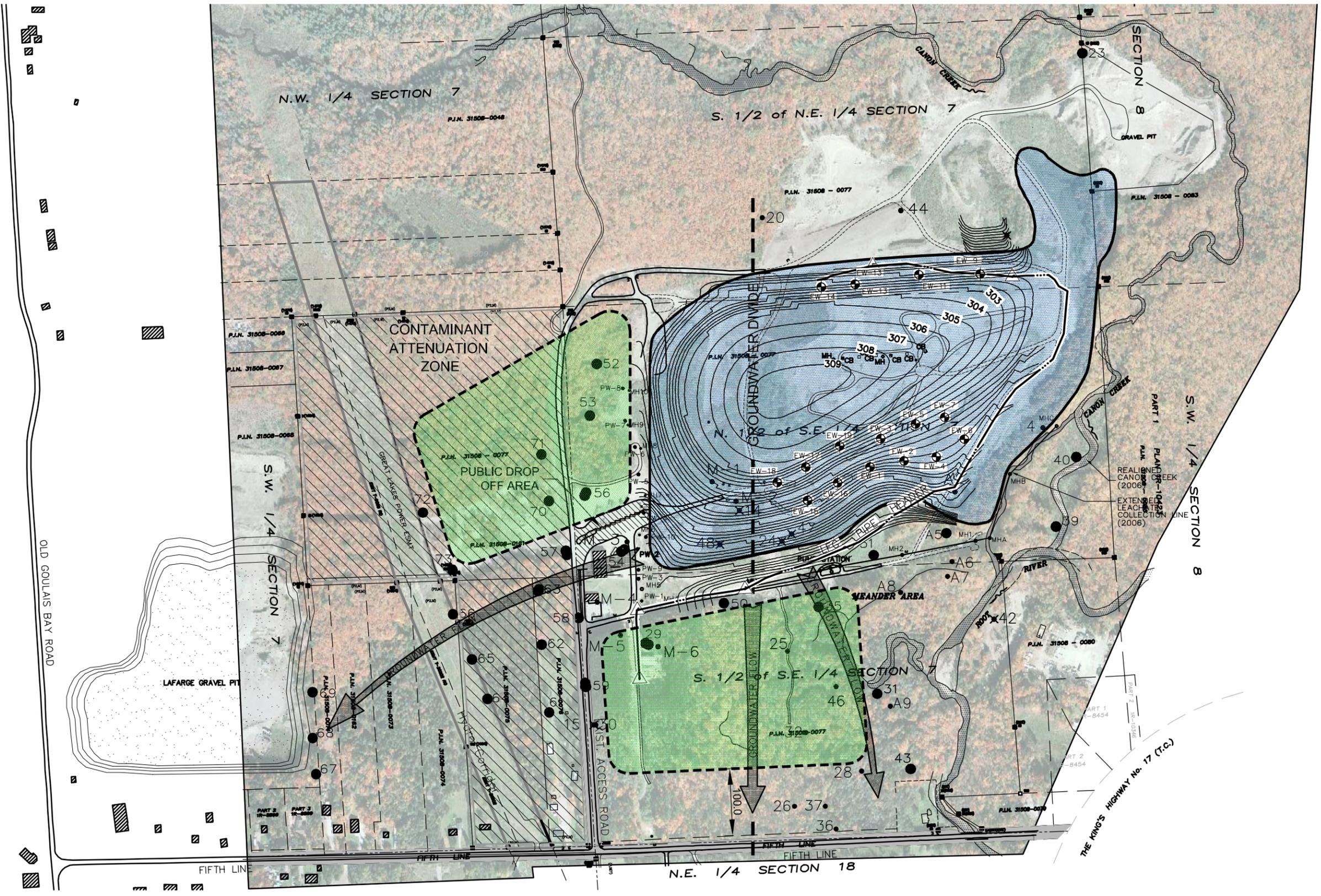


Legend:	
✕ 24	MONITORING WELL THAT NO LONGER EXISTS
● 52	MONITORING WELL NOT SAMPLED IN 2007
● PW 3	PUMPING WELL
— MH 3	LEACHATE COLLECTION SYSTEM
---	PROPERTY BOUNDARY
---	LIMIT OF FILL
● 40	MONITORING WELL SAMPLED IN 2007
● M-1	METHANE GAS MONITOR
	FORMER CREEK LOCATION
	NEW CREEK LOCATION
	EXISTING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



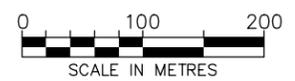
<b>Sault Ste. Marie Municipal Landfill Site</b>		
<b>OPTION 3</b>		
<b>WEST AND NORTH EXPANSION B</b>		
Proj. Manager: KK	Drawn By: SKB	Figure No. <b>4</b>
Scale: 1 : 6000	Checked By: FRG	
Date Issued: NOV. 2011	Project No: 06-6988	
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- Legend:**
- ✕ 24 MONITORING WELL THAT NO LONGER EXISTS
  - 52 MONITORING WELL NOT SAMPLED IN 2007
  - PW 3 PUMPING WELL
  - MH 3 LEACHATE COLLECTION SYSTEM
  - — — PROPERTY BOUNDARY
  - — — LIMIT OF FILL
  - 40 MONITORING WELL SAMPLED IN 2007
  - M-1 METHANE GAS MONITOR

- FORMER CREEK LOCATION
- NEW CREEK LOCATION
- EXISTING BUILDING/RESIDENCE
- PROPOSED LANDFILL EXPANSION
- EXISTING LANDFILL
- LFG EXTRACTION WELL



Sault Ste. Marie Municipal Landfill Site  
**OPTION 4**  
 WEST AND SOUTH EXPANSION

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



**Legend**

 LANDFILL BOUNDARY



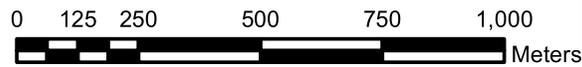
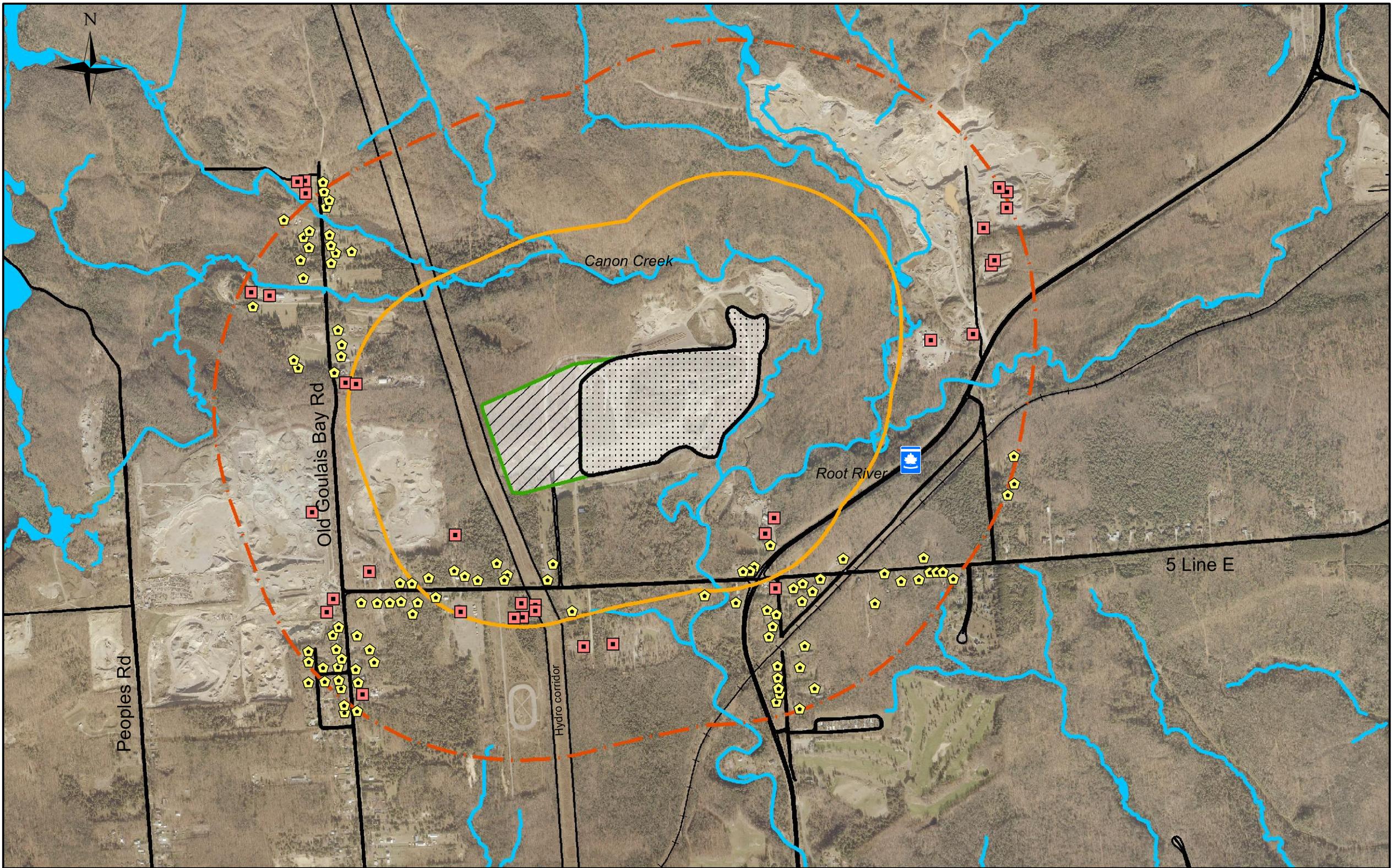
**THE CITY OF BARRIE LANDFILL**

Project Manager: KK  
 Scale: 1 : 20 000  
 Date Issued: SEPT 2011  
 Location: P:\2006\066988

Drawn By: SLP  
 Checked By: BMV  
 Project No: 06-6988  
 File Name: City of Barrie Landfill

Figure No.

**6**



Sault Ste. Marie Municipal Landfill Site

**OPTION 1  
WEST EXPANSION**

**Legend**

- TRANS-CANADA HIGHWAY
- ROADS
- RAILWAY
- WATER BODY

- EXISTING LANDFILL
- PROPOSED LANDFILL EXPANSION
- 1000 m STUDY AREA
- 500 m STUDY AREA

- BUILDINGS**
- Industry
  - Residence
  - School

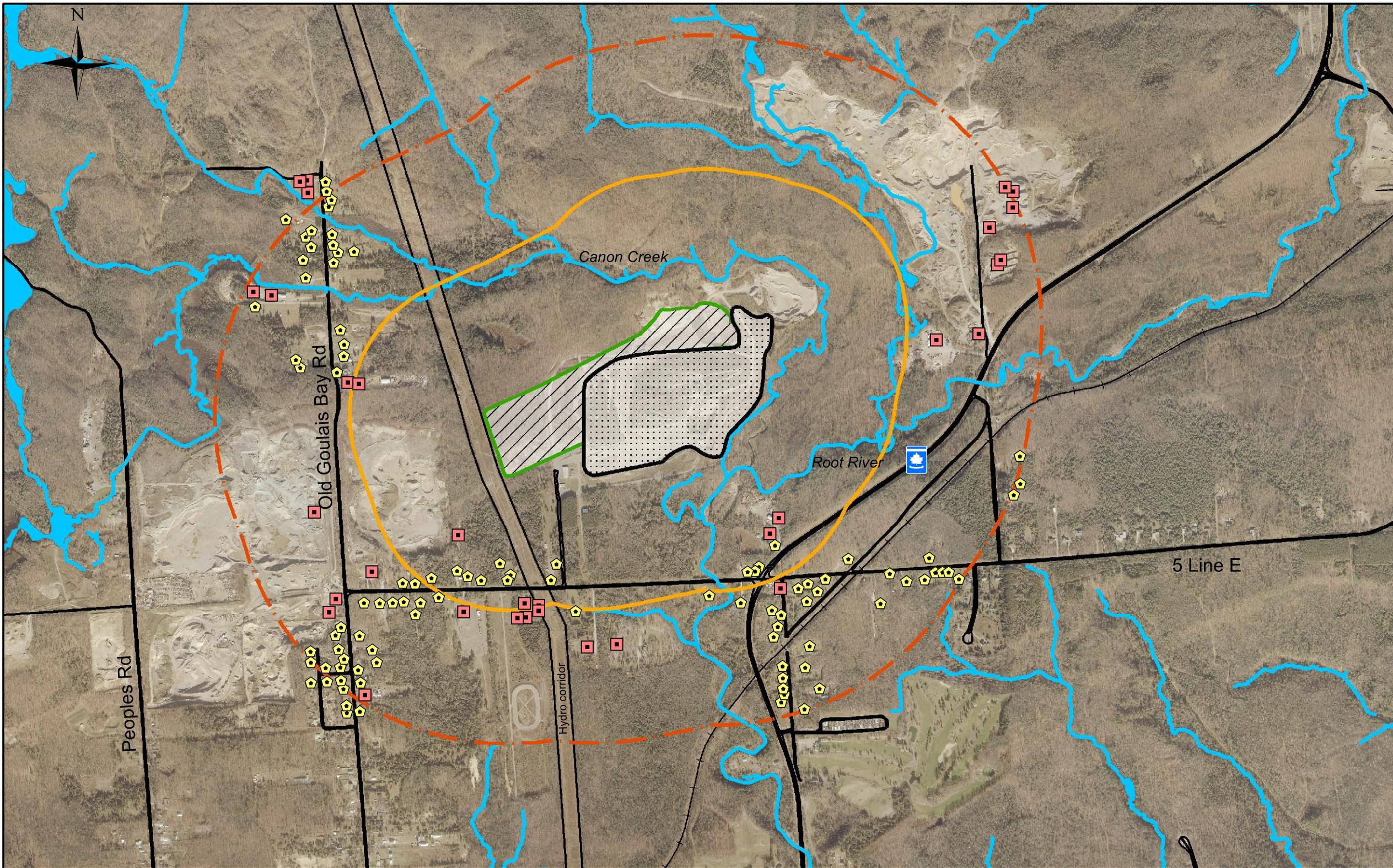


Project Manager: KK  
 Scale: 1 : 20 000  
 Date Issued: FEB 2012  
 Location: G:\GIS\066988

Drawn By: SLP  
 Checked By: BV  
 Project No: 06-6988  
 File Name: SSM Option 1 - 2012

Figure No.

**7**



**Legend**

-  TRANS-CANADA HIGHWAY
-  ROADS
-  RAILWAY
-  WATER BODY

-  EXISTING LANDFILL
-  PROPOSED LANDFILL EXPANSION
-  1000 m STUDY AREA
-  500 m STUDY AREA

- BUILDINGS**
-  Industry
  -  Residence
  -  School



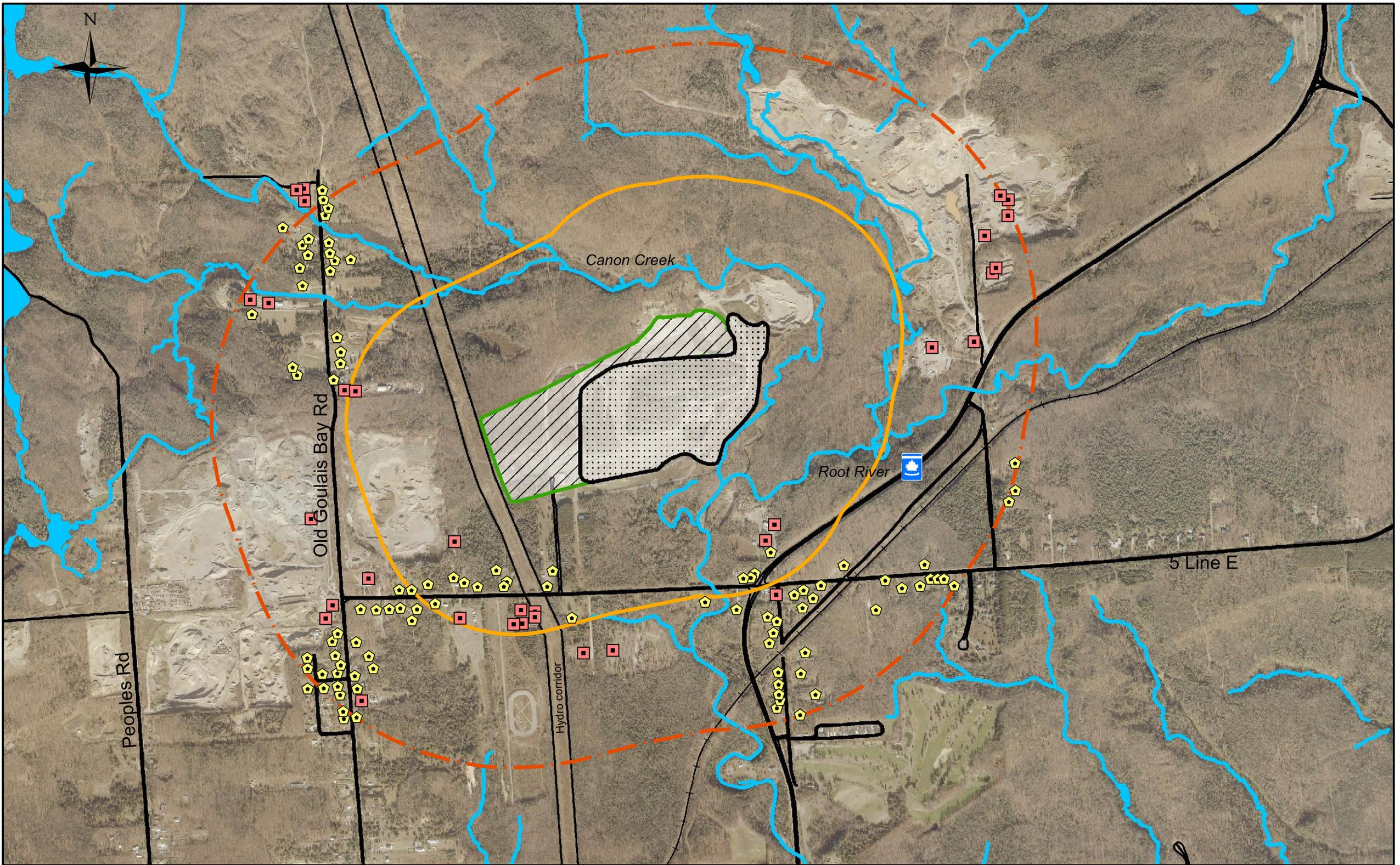
Sault Ste. Marie Municipal Landfill Site  
**OPTION 2**  
**WEST AND NORTH EXPANSION A**

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

Drawn By: SLP  
 Checked By: BV  
 Project No: 06-6988  
 File Name: SSM Option 2 - 2012

Figure No.

**8**



**Legend**

- |  |                      |  |                             |                  |
|--|----------------------|--|-----------------------------|------------------|
|  | TRANS-CANADA HIGHWAY |  | EXISTING LANDFILL           | <b>BUILDINGS</b> |
|  | ROADS                |  | PROPOSED LANDFILL EXPANSION |                  |
|  | RAILWAY              |  | 1000 m STUDY AREA           |                  |
|  | WATER BODY           |  | 500 m STUDY AREA            |                  |

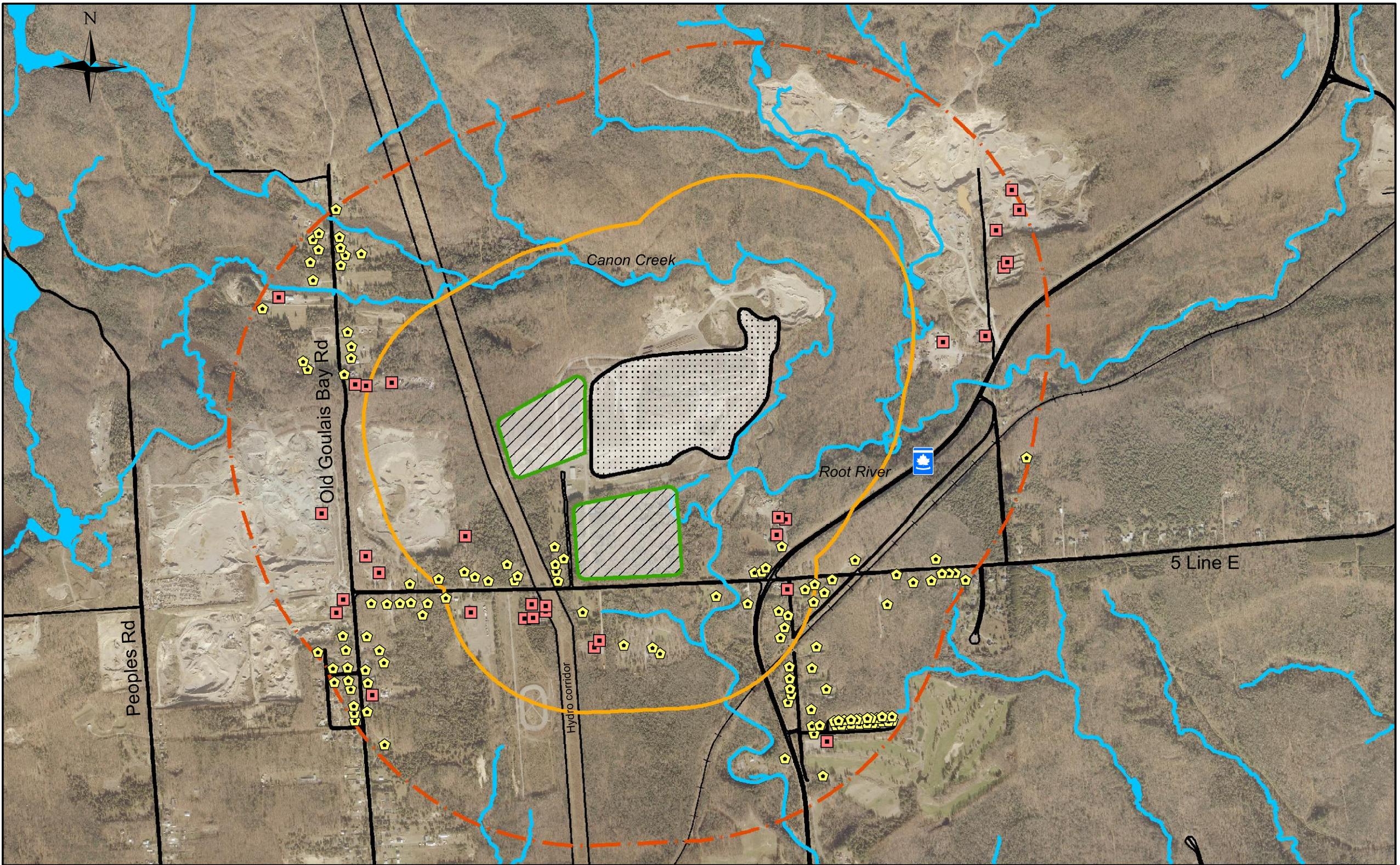
Sault Ste. Marie Municipal Landfill Site  
**OPTION 3**  
**WEST AND NORTH EXPANSION B**

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

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

Figure No.

9



- Legend**
- TRANS-CANADA HIGHWAY
  - ROADS
  - RAILWAY
  - WATER BODY
  - EXISTING LANDFILL
  - PROPOSED LANDFILL EXPANSION
  - 1000 m STUDY AREA
  - 500 m STUDY AREA
- BUILDINGS**
- Industry
  - Residence
  - School

Sault Ste. Marie Municipal Landfill Site  
**OPTION 4**  
**WEST AND SOUTH EXPANSION**

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

Drawn By: SLP  
 Checked By: BV  
 Project No: 06-6988  
 File Name: SSM Option 4 - 2012

Figure No.  
**10**