

STAFF REPORT: ENGINEERING & PUBLIC WORKS SOLID WASTE DIVISION

REPORT TO: Infrastructure & Recreation Committee
MEETING DATE: September 14, 2010
REPORT NO.: EPW.10.091
SUBJECT: Landfill Environmental Screening -
Status Update
PREPARED BY: Jeffery Fletcher, Manager of Solid Waste
and Environmental Initiatives

A. Recommendations

THAT Council receive Staff Report EPW.10.091 Landfill Environmental Screening - Status Update for their information.

B. Background

In 2008, the Town initiated two Environmental Screening Processes (ESP) which proposed the expansion and mining of The Blue Mountains Landfill (the Site) to address the problem of diminishing disposal capacity, and provide a long-term environmentally safe solid waste disposal solution for the Town.

Golder Associates Ltd. (Golder) was retained to assist in completing these Environmental Screening Processes. The ESP is a comprehensive and environmentally sound planning procedure that incorporates public consultation involving a wide variety of stakeholders. This Process has involved two public consultation events and a 12 step Screening Process which is prescribed by the Ministry of The Environment (MOE).

To complement this Screening Process the Town completed in 2008 an *Existing System Summary Report* and a *Waste Diversion Plan*. The goal of the Waste Diversion Plan is to identify initiatives that could capture additional quantities of waste and maximum the remaining and any new waste disposal capacity, while at the same time achieving the provincial target of 60% diversion.

Problem/ Opportunity

Even with the full implementation of the Waste Diversion Plan, the Town is still approaching disposal capacity and to provide a long-term environmentally safe solid waste disposal solution, the Town proposes to expand the existing landfill by 100,000 m³ and gain 100,000 m³ of capacity through landfill mining. This 200,000 m³ represents between 15 and 20 years of additional capacity based on population projections, current landfill disposal rates and the new proposed waste diversion initiatives.

The purpose of the ESP is to assess the feasibility of expanding and mining the existing The Blue Mountains Landfill to address the problem of diminishing local disposal capacity.

Description of Proposed Undertakings

Expansion

It is proposed to expand the existing landfill capacity by 100,000 m³ through two options:

- excavate, engineer and prepare a new landfill cell outside the approved landfill footprint but inside the existing landfill boundaries; or
- vertical expansion over all or part of the existing landfill footprint.

It is proposed to complete the Site expansion in conjunction with the proposed landfill mining for the purpose of providing a disposal capacity for the residual waste from the mining process. Expansion would increase the disposal capacity of the Site from the licensed volume of 370,000 m³ to 470,000 m³.

Mining

Landfill mining refers to the process whereby the existing waste fill is excavated and screened to remove the fine fraction (soil component) from the waste. Landfill *reclamation* refers to the broader project, which involves re-engineering of the landfill and then re-landfilling using a greater level of compaction and less soil cover than what was originally used. Landfill reclamation at this Site is anticipated to provide an estimated 100,000 m³ of air space. The air space will provide an increase in Site life, *without* increasing the overall approved fill volume capacity of the landfill (i.e., 370,000 m³ prior to any proposed expansions). In the *2009 Solid Waste Report*, the remaining Site life without reclamation was estimated to extend to the year 2011. It is estimated that the reclamation process could extend the Site life by an additional 10 years.

The works proposed for the reclamation and re-engineering of The Blue Mountains Landfill include the following:

- Excavation of previously landfilled waste, by mechanical segregation and screening of the waste to remove the “fines” fraction, which is comprised primarily of sandy soil with an organic component (e.g. wood) and some plastic and glass;
- Recovery of recyclable material (tires, metal, etc.);
- Placement of the coarse “oversize” fraction from the screening process into newly constructed areas of the landfill and re-use of the fines fraction for daily and interim cover. Temporary stockpiling of excess fines are anticipated to be required at intermediate stages of the project; and

- The excavation, engineering and preparation of a new landfill base beneath the waste reclamation areas.

The removal and reuse of fine materials (as routine / daily cover material) during the mining process eliminates the need to import landfill cover material. By reclaiming capacity in the existing landfill, the potential environmental impacts that would be associated with displacing land for the purpose of a new landfill Site are avoided.

Reclamation offers an environmentally sound means of maximizing the existing waste disposal Site. It allows the Town to continue to provide a secure long-term means of waste disposal for its permanent and seasonal residents as well as the institutional, commercial and industrial facilities (IC&I) within the municipal boundaries. The proposed mining options / scenarios are discussed and shown in greater detail in Attachment 1 and 2 of this report.

Screening Criteria

In order to identify the potential environmental effects of landfill expansion and mining of the Site, a screening criteria checklist was completed in accordance with Step 3 of the Environmental Screening Process. Application of the screening criteria identified the following three potential environmental effects, concerns or issues, warranting further investigation, studies and ultimately leading to the development of impact management and mitigation measures:

- Potential for Surface Water and Groundwater Effects;
- Potential Air and Noise Effects; and
- Potential for Scenic View Effects.

The ESP reviewed and assessed the characteristics of the landfill, and evaluated mitigation measures (i.e., engineered leachate collection system), to demonstrate possible improvements to prevent groundwater and surface water contamination.

The Scenarios developed work to mitigate these identified potential environmental effects. The Environmental Protection Act component of this project and the detailed design and operations plan will include greater detail on how these potential effects will be mitigated.

Public Consultation

This process has involved 3 main public consultation activities:

- Notice of Study Commencement (September 2008) – Posting and mailing contact list;
- Round one of public consultation events (January 2009) - outline and update public on the process and collect input; and

- Round two of public consultation events (April 2010) – provide status update and collect input.

The project has involved consultation with Ministry of Environment staff from the Waste Approvals Branch and the Local Office. The project team has also been contacting six First Nations communities at every stage of consultation. The project team is continuing to pursue the First Nations communities for their input and is working directly with the Ministry of Environment in this regard.

The Table below summarizes the number of responses from attendees for each impact category listed in the feedback questionnaire from the January 2009 consultation events.

Impact Category	Number of Responses			
	Very Concerned	Concerned	Not Concerned	Very No Concern
Groundwater	6			1
Surface Water	4	2		1
Biological Impacts	2	2	1	1
Traffic Impacts		1	3	1
Noise		1	4	1
Litter, Debris, etc.	1	4		1
Odour		4		1
Public Safety	1	3		1
Aesthetics	4			1
Property Value	4	1		1
Other: Landfill Life	1			

Capacity and Site Life

The Screening Process has developed 4 expansion scenarios which are described briefly below:

- Scenario 1 – northern expansion and mining of Thornbury area and The Blue Mountains area east;
- Scenario 2 – vertical expansion of The Blue Mountains area and mining of Thornbury area and The Blue Mountains area;
- Scenario 3 – vertical expansion of The Blue Mountains and mining of the only Thornbury area; and
- Scenario 4 – northern expansion only

Based on the input parameters discussed in the 4 expansion/ mining scenarios in Attachment 1, Attachment 2 and a detailed evaluation of Site capacity and life the following conclusions are made:

- Scenario 1 and 2 are based on identical expansion and mining volumes and as a consequence they result in the same estimated future Site life.
- The new cell expansion for Scenario 1 is delayed by one year compared to Scenarios 2 and 3 to allow time for constructing the new northern cell.
- Scenarios 2 and 3 propose a vertical expansion (1.4m to 2.0m) on top of the existing The Blue Mountains landfill, which could be utilized immediately.
- The estimated Site life from Scenarios 1 and 2 is approximately 17 years (i.e., 2027), based on the assumptions discussed in the preceding sections.
- Scenario 3 also provides more immediate capacity, but will only provide an additional 11 years of Site life (i.e., 2023) due to the smaller volume of mining.
- Scenario 4 provides a new cell with disposal capacity for an estimated 7 - 8 years (i.e., 2019 - 2020).

Compost Diversion and Extended Site Life

Recently a source separated organics (SSO) study was completed that examined the options and costs involved in running a program to divert SSO. It is useful to understand what impact the diversion of organics will have on the long term life of the landfill. As determined by the SSO study, if implemented, a residential based SSO program could divert 600 tonnes of organics per year. That tonnage translates into an estimated volume of 1,600 m³. Saving that volume of waste every year for the next 17 years (estimated expansion Site life under scenario 2) would create an additional 3 years of landfill life, extending the estimated Site life to year 2030.

Groundwater Impacts

Two cross-sectional groundwater flow models were constructed to simulate groundwater flows and predict the potential impacts of the proposed Scenarios 1, 2 and 3. Scenario 4 was not simulated separately since it is identical to the expansion proposed in Scenario 1, enabling the use of the results obtained from Scenario 1.

Based on data developed from the flow and chemical dissolve models it is clear that the greatest reduction in contaminant mass observed at the boundary occurs when a liner is used. It is also clear that the critical area with respect to compliance is located nearest to Indian Brook. Compliance for this section was assessed both in terms of the Ministry of Environment B-7 groundwater criteria as well as the Provincial Water Quality Objectives. The predicted concentrations of Ammonia exceeded the PWQO at the compliance boundary in all unlined scenarios.

Based on the modelling results it is concluded that future new cells should include a liner as part of the future landfill design. A single composite liner, designed in accordance with the MOE Landfill Standards (May 1998) is proposed.

Permitting and Design

Upon completion of the Environmental Screening Process and following MOE approval to undertake expansion and mining of the Site, environmental permitting approvals are required under the *Environmental Protection Act, R.S.O. 1990* ("EPA").

Upon successful completion of the permitting process, the applicant is granted a Certificate of Approval (C of A), or other permit documents that, in addition to referring to the legislated requirements, may place Site specific limits on the operations.

The environmental permitting requirements applicable to this undertaking are as follows:

- Section 27 EPA application for a C of A for a waste disposal Site; and
- Section 9 EPA application for a C of A for air and noise emissions.

The completion of a Section 27 EPA application will be a compulsory undertaking for the proposed expansion and mining of the Site, with the completion of a Section 9 application only if determined as a requirement by the MOE.

The accompanying application package for the C of A consists of supporting documentation, including the preparation of technical studies that assess the impact of the proposed project on environmental components. These studies include:

- Design and Operations Report;
- Hydrogeological Assessment;
- if required, an air dispersion model; and
- if required, an acoustic assessment report.

Conclusions

- Significant air and noise impacts outside current landfill operations are not anticipated for the expansion and mining process at The Blue Mountains Landfill.
- A Best Management Practices Plan to mitigate potential Dust, Odour and Noise impacts has been developed.
- Based on historical water quality observations, slightly elevated concentrations of chloride are commonly observed at locations impacted by the Thornbury and The Blue Mountains landfills, but are below the compliance limits defined by the RUC.
- Elevated sulphate associated with landfill leachate impact has been identified to the east of the Site and exceeds the RUC.
- Elevated nitrate may be associated with the landfill impacts to the east and to the south, however agricultural sources cannot be ruled out. At some locations nitrate is considered to be associated with off-Site agricultural impacts.
- Scenarios 1 and 2 provide an estimated net capacity gain of 180,000 m³, and approximately 17 years of remaining Site life.
- Scenario 3 provides an estimated net capacity gain of 151,000 m³, and approximately 11 years of remaining Site life.
- Scenario 4 provides a capacity gain of 100,000 m³ and approximately 7 to 8 years of remaining Site life.
- In all cases, the scenarios run based on new unlined cells resulted in exceedance of compliance criteria.

Environmental Screening Report Recommendations

- Future new cells constructed at The Blue Mountains Landfill should include a liner and leachate collection system as part of the future landfill design. A single composite liner, designed in accordance with the MOE Landfill Standards (May, 1998) is recommended.
- The results of the comprehensive Evaluation Matrix identify scenario 2 as the preferred option for the Town (Attachment #4).

Next Steps

A draft of the Expansion and Mining Screening Report is currently being reviewed by multiple branches of the Ministry of Environment in a pre-submission phase. Town Staff have been informed by the MOE that their pre-submission review will be complete by the end of September. This review will provide comments on the screening document for consideration by the Town. This review also provides an opportunity to adjust the report if required to assist with a successful final approval.

Town Staff will return to Council with a final report before submitting the Notice of Completion and initiating the 60 day review period.

C. The Blue Mountains' Strategic Plan

This solid waste project addresses the Town Municipal infrastructure needs and addresses Strategic Action 2.5 "develop a waste management strategy to meet diversion targets and address landfill capacity".

D. Environmental Impacts

Installation of a composite liner within the eastern area of the existing landfill has been identified as the preferable environmental option to allow for the increased protection of the local groundwater and Indian Brook. Expansion and mining scenario 2 provides an opportunity to remediate the Thornbury section of the Landfill and resolve the exceedance of the Reasonable Use Criteria at the eastern boundary of the Site.

Expanding the solid waste infrastructure will provide viable local waste disposal, which is an important component in providing a complete waste management program and sanitation in our urban and rural communities.

E. Budget Impact

Environmental Screening Costs

The Environmental Screening is remaining on the target budget of \$307,000 and it is expected that the ESP will be complete before the end of 2010. A contingency amount of \$40,000 for any additional studies during the ESP has been reallocated by Staff Report EPW.10.045, Extension of Engineering Contract for Landfill Environmental Screening, to begin work on a new design and operations plan. This work will get a head start on the preliminary work for Certificate of Approvals and detailed design and tendering documents.

Environmental Protection Act, Design and Tender Costs

As discussed above a design and operations plan is the next step that will in part fulfill the environmental permitting approvals under the *Environmental Protection Act* (EPA) – the next phase of this project. The estimated costs for the EPA phase is \$75,000. In addition to the \$40,000 highlighted above, will be \$35,000 for landfill design, drawings and tender specifications based on the design and operations plan and certificate of approvals.

Additional work and fees will be required if air dispersion modelling and an acoustic assessment report is deemed necessary by the MOE.

Landfill Reclamation and Construction Costs

The estimated costs for waste reclamation and the construction of the new proposed cells for each of the proposed scenarios are reflected in Attachment 3. The new landfill cell construction costs are based on the provision of a full Site liner and leachate collection system, identified as the environmentally preferred solution for future landfill operations at the Site. Quantities reflected in the tables are estimated values based on preliminary assessment of reclamation and cell construction areas.

The recommended scenario 2 has an estimated construction cost of \$7.5 million, which will provide an estimated 17 years of additional capacity.

Leachate Treatment Costs

With the installation of an engineered landfill cell comes the generation and collection of leachate. Attachment 3 includes a table outlining the annual costs of leachate transportation and treatment. Scenario 2 details a total annual cost of \$213,500 for leachate transport and treatment.

Annual Operational Costs

As part of the ESP the current and future landfill operational costs were evaluated to determine the impact on the options being investigated.

The 2010 annual operational budget for the landfill is \$525,000 with annual revenue of \$258,000 from collected disposal fees, resulting in a net operational cost of \$267,000.

The Town recently completed a composting study that examined the waste management (i.e., collection, transfer, etc.) and operational cost impacts with the closure of the Landfill Site. It was estimated that if no future expansion or mining were to be undertaken, resulting in closure of the Site by mid 2012 (i.e. *Do Nothing Scenario*), that the net annual operational cost would increase to approximately \$703,200. This cost was based on the requirement to direct haul curbside waste to an alternate disposal facility at a cost of \$245,400, including \$320,900 for transport and disposal of approximately 1,900 tonnes from the Town's Transfer Station located at the landfill. In addition to the transfer and disposal costs, the annual transfer station operational costs are estimated to be \$326,900. Revenue generated at the transfer station is estimated at \$190,000.

In contrast to the Do Nothing Scenario, the site life extension through landfill mining and expansion would result in an estimated net annual operational cost of \$480,700. This cost is based on an annual Site operational cost of \$738,700 (Site operations + leachate management) minus estimated net revenue of \$258,000 from landfill disposal fees.

Therefore, landfill mining and expansion at the Landfill provides the Town with the opportunity to extend Site life, but also to lower the operational costs increase relative to the alternative *Do Nothing Scenario* option.

The relative benefit of the four proposed expansion and mining scenarios in contrast to the Do Nothing scenario, with respect to operational costs, is reflected in the Evaluation Matrix in Attachment 4.

Annual Composting Costs

In addition to annual landfill or transfer station costs are SSO composting costs (if this service is provided). As noted previously in this report composting could provide an additional 3 years of landfill life on top of the scenario 2 option. In the recent *Composting and Operations Business Case* completed in June 2010, an examination of the cost of open windrow composting of 600 tonnes of SSO was conducted. This study concluded that the annual capital amortization and operating costs of composting SSO at the existing Town facility would be in the range of \$90,000 to \$113,000, depending on the level of technology utilized.

Comprehensive Capital and Operational Cost Summary

The costing information above is an overview of the permitting, design, construction and potential operational costs involved with the landfill expansion and mining project. A comprehensive report on project financing and life cycle analysis costs is being developed with Financial Services and Golder. In addition to using the MOE feedback, Staff will develop variations on tipping fee rates and taxation to assist with project financing and extension of estimated expansion Site life.

F. Attached

1. Proposed Landfill Expansion and Mining Scenario Development
2. Scenario 1-4 Figures
3. Scenario Summary
4. Evaluation Matrix

Respectfully submitted,

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Appendix 1

1.1.1 Proposed Landfill Expansion and Mining Scenario Development

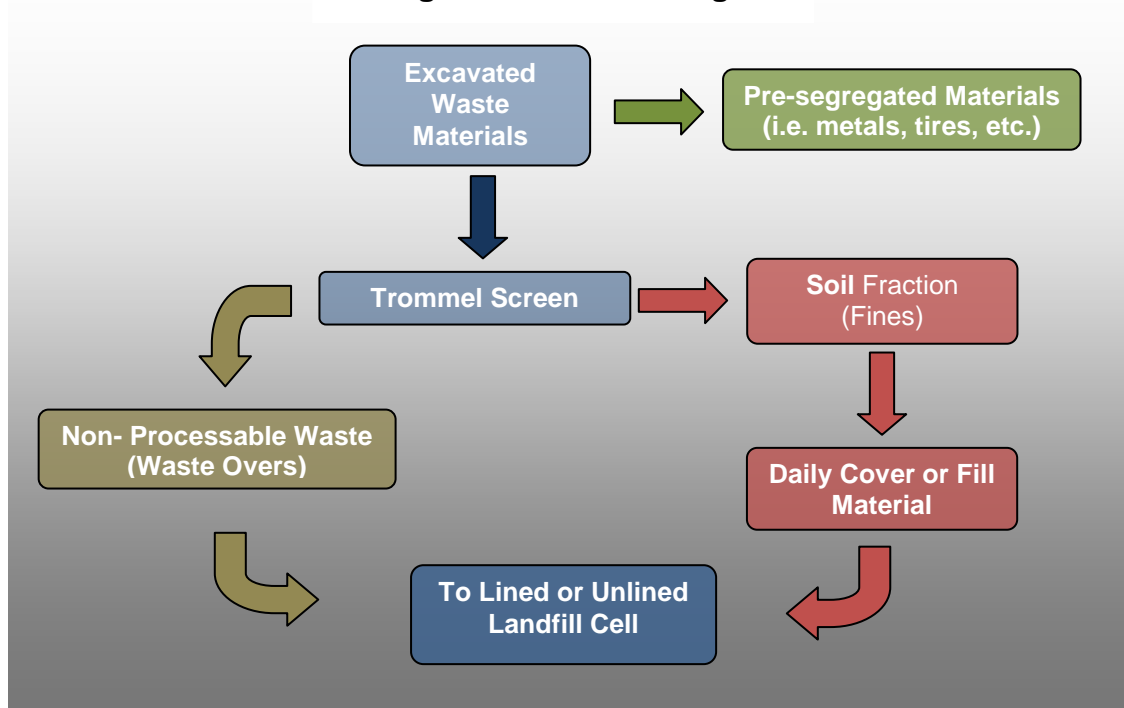
Based on the Site information discussed in the preceding sections, four proposed scenarios for expansion and mining were developed for assessment. The scenarios are based on the following conditions set by Ontario Regulation 101/07:

- Landfill expansion is limited to a maximum of 100,000 m³; and
- Mining of previous waste disposal areas to gain a maximum 100,000 m³ **without** increasing the original total waste disposal volume of the landfill Site.

1.1.1.1 Landfill Mining / Reclamation

The process of waste mining follows the materials flow diagram presented below. As the waste is excavated, bulky salvageable material (white goods, scrap metal, tires, concrete, etc.) that can be readily segregated will be set aside and recycled, processed (i.e., shredded, crushed, etc.). Excavated material will be run through a trommel screen and separated into fine and coarse (i.e., waste overs) fractions (refer to photographs 1 and 2). Coarse material is taken to the active face for disposal, whereas fine material will be stockpiled and re-used as operational cover material. Pending market conditions and material specifications of recycled metals, it may be possible to recycle the metallic component of the reclaimed waste.

Mining Process Flow Diagram





Photograph 1: Waste Overs (Non-Processable Waste)



Photograph 2: Fines (Soil Fraction)

Additional disposal capacity gained from the mining process is obtained largely as a result of using the screened fines as cover material, offsetting the need to import new cover material. Mining also increases disposal capacity by providing opportunity to remove recyclable materials, remove and reduce the size of oversized waste items, and improve waste compaction during the re-landfilling of waste overs. For the purpose of developing the scenario volumes and based on experience on other similar landfill mining projects, it was assumed that the in-place waste at the Site would consist of 40% waste overs to a 60%

finer component. The proposed expansion and mining volumes for the scenarios, including estimated time frames are discussed further in Section 6.2.4.

1.1.1.2 Landfill Lining / Re-Engineering

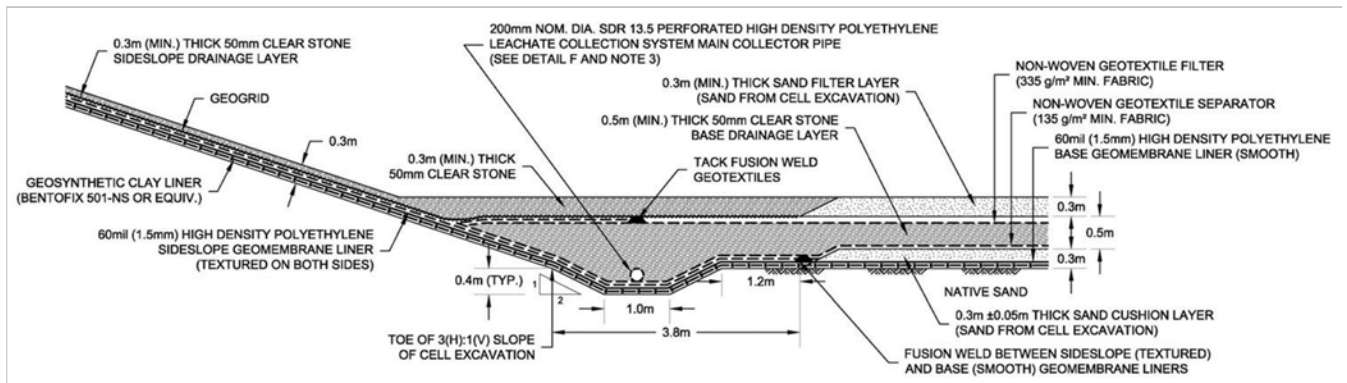
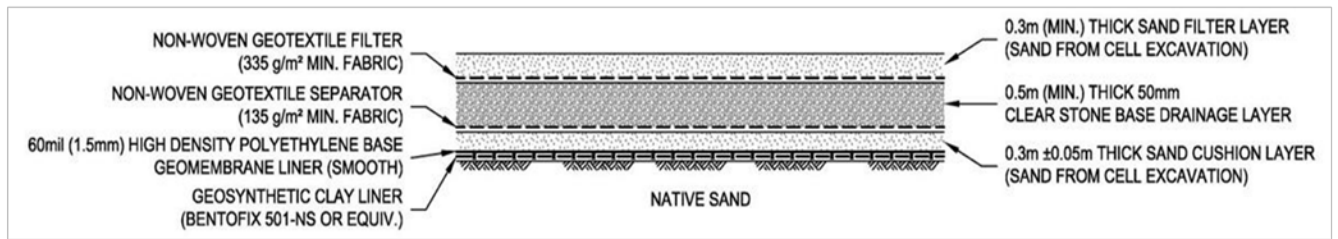
It was recognized that whereas the current landfill design is a “natural attenuation” facility, the current exceedances of the RUC suggested that lining of the new cells would potentially be required, particularly with the addition of waste to the Site. As a result, the proposed Scenarios all included evaluation of the impacts with and without a liner, in order to assess the relative impacts of the “natural attenuation” versus “engineered” landfill cells. For this approach, a Site Specific Design was developed in accordance with the MOE *“Landfill Standards – A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfill Sites”*, dated May 1998. It is recognized, however, that a portion of the Blue Mountains landfill (largely the existing western area) will remain unlined for all scenarios.

The proposed Site specific leachate containment system will consist of a leachate collection system underlain by a single composite liner. The leachate collection system will consist of a series of perforated High Density Polyethylene (HDPE) pipes placed within a 0.5 m thick, 50 mm clear stone drainage layer over the base area of the landfill cells. The leachate collection pipes will be placed at grades to enable drainage by gravitation to a single collection manhole, from which the leachate would be pumped and transported to a sewage treatment facility. To protect the clear stone drainage layer from intrusion of soil fines, the clear stone is overlain by a geotextile filter fabric and then a 0.3 m thick sand filter layer over the base area of the landfill.

The single composite liner under the leachate collection system will comprise of a 1.5 mm (60 mil) thick HDPE geomembrane liner and an underlying geosynthetic clay liner (GCL). The GCL component of the composite liner consists of a layer of unhydrated, loose, powdered bentonite which is mechanically adhered to and sandwiched between two layers of non-woven geotextile fabric. When subjected to a confining pressure such as that due to the weight of the overlying waste fill and exposed to moisture (leachate and/or moisture from the underlying native soils), the bentonite swells and forms a low permeability barrier layer. The use of a natural compacted clay liner in place of a GCL was not evaluated, as suitable natural clay is not readily available in the area and as a result, would require the importation of clay material and additional associated costs.

To protect the geomembrane liner against puncture by the overlying clear stone drainage layer, a 0.3 m thick sand cushion layer is placed between the geomembrane and the clear stone drainage layer over the base area of the landfill.

Site Specific GM-GCL Design



The above proposed leachate containment system was used in the scenario modeling and preliminary cost estimates discussed in the sections that follow.

1.1.1.3 Scenarios

The proposed scenarios discussed in the following sections were modelled and assessed with the following assumptions:

- new landfill cells (expansion and reclaimed) continue to operate as natural attenuation landfills (i.e. status quo); or
- new and reclaimed landfill cells will be constructed using a newly engineered leachate containment system.

1.1.1.3.1 Scenario 1 – Northern Expansion and Mining of Thornbury / Blue Mountains

Scenario 1 is presented on Figure 8 and is based upon the following sequence of events:

- A new landfill cell (Area 1 on Figure 8) will be constructed to the north and west of The Blue Mountains Landfill and Thornbury landfills respectively, providing a total additional disposal capacity of 100,000 m³. This will increase the current waste disposal capacity of the Site from 370,000 m³ to 470,000 m³, and estimated to be completed at the end of 2012. The approximate dimensions of the new proposed cell are 170 m long by 100 m wide, with a fill depth of approximately 6 m below the existing grade. It is recommended that the completed cell be constructed to similar grades as that of the existing Blue Mountains Landfill.
- Following completion of the new cell (Area 1), mining of the old Thornbury Landfill and the eastern side of the Blue Mountains Landfill (Area 2 on Figure 8) will commence. The proposed volume to be mined is approximately 200,000 m³, with the newly constructed northern landfill cell (Area 1) to be

utilized for the landfilling of waste reclamation overs (i.e., screened waste) and fines (i.e., used as daily cover) for the period of the mining (2013 to 2014). Based on the assumed 40%:60% waste to fines split, approximately 80,000 m³ of waste overs and 120,000 m³ of fines will be produced during the mining process. Fines will be stockpiled within the landfill footprint and used as daily and interim cover during landfilling of new incoming waste and waste overs.

- It is assumed that mining of the Thornbury and eastern Blue Mountains Landfill would be conducted over a 2 year period. Utilizing screen equipment capable of 750 m³/day and a 5 day working week, reclamation of approximately 100,000 m³ during a 6 to 7 month period (March to September) could be accomplished. Expansion and mining volumes including time frames are discussed further in Section 5.2.5.
- The newly constructed northern cell (Area 1) will reach capacity at completion of mining operations and would have been utilized for the re-landfilling of approximately 100,000 m³ of waste overs and fines from the mining process. It is envisioned that at this time, landfilling will relocate to the landfill cells to be constructed in the mined areas (Area 2 on Figure 8). The reclaimed areas would provide an estimated 200,000 m³ which is a direct offset to the expansion volume lost to re-landfilling old waste (100,000 m³), including a net gain from mining 100,000 m³. This new cell will be utilized for the disposal of Town waste with daily and interim cover from fines stockpiled during the mining process.

1.1.1.3.2 Scenario 2 – Vertical Expansion and Mining of Thornbury / Blue Mountains

Scenario 2 is presented on Figure 9 and is based on the following sequence of events:

- Scenario 2 is similar to Scenario 1, but proposes a 100,000 m³ vertical expansion of the existing The Blue Mountains Landfill (Area 1 on Figure 9) in place of constructing a new cell outside the existing landfill footprint. The area of the vertical expansion is estimated to be approximately 5.5 hectares and would result in a 1.8 m to 2 m lift across the western part of the BML (Area 1). (*Note: lining of The Blue Mountains landfill is not possible during vertical expansion*)
- Identical to Scenario 1, mining of waste in the Thornbury Landfill and the eastern side of the BML (Area 2) will be completed over a two year period, but will commence immediately as the reclaimed “overs” will be placed in the vertical lift area (Area 1). The proposed volume to be mined is approximately 200,000 m³.
- Similar to the Scenario 1 sequence of events, landfilling of municipal waste will move to the mined areas once the 100,000 m³ vertical expansion has been filled with waste overs and fines from the proposed mining operations.

1.1.1.3.3 Scenario 3 – Vertical Expansion and Mining of Thornbury

Scenario 3 is presented in Figure 10 and is based upon the following sequence of events:

- Scenario 3 proposes to undertake reclamation of only the Thornbury Landfill (Area 1) over a one year period. Scenario 3 is a vertical expansion of the Site, wherein reclamation is only undertaken with the purpose of addressing the RUC exceedances believed to be from contaminants originating from the Thornbury landfill.
- The proposed reclamation volume will be approximately 100,000 m³, which is the estimated volume of the Thornbury Landfill. Based on a conservative 40%:60% waste to fines ratio of in place waste material, the estimated volume of fines would be 60,000 m³, with 40,000 m³ of waste overs.
- Similar to Scenario 2, a vertical expansion of the existing BML is proposed, but will be across the full extent of the existing BML (Area 2), covering approximately 7.15 hectares. The 100,000 m³ vertical

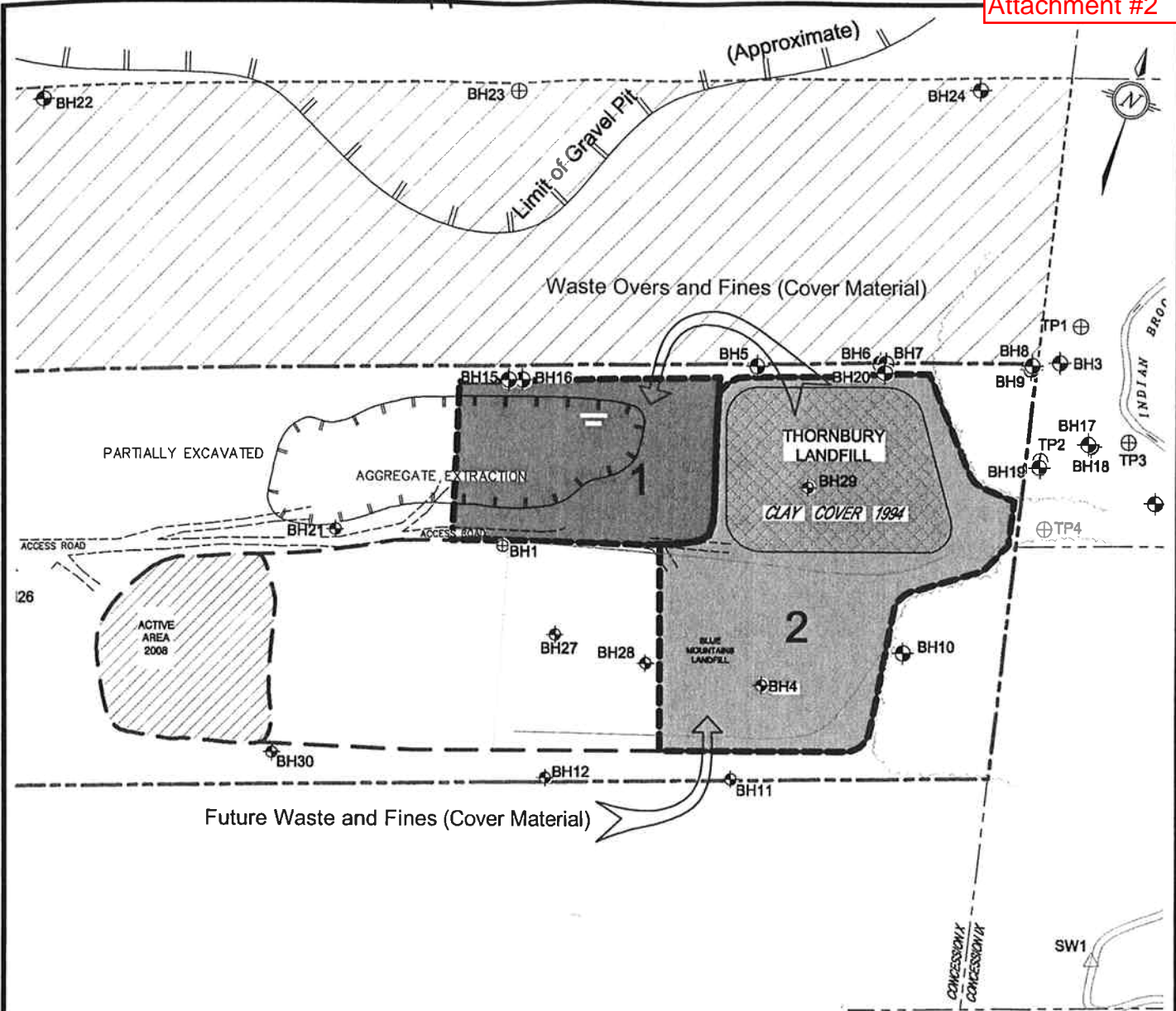
expansion would require a 1.4 to 1.5 m lift across the existing BML (Area 2). The vertical expansion will be utilized for waste overs from the Thornbury mining process including new incoming waste. Once the vertical expansion capacity is reached landfilling of municipal waste will move to the re-engineered Thornbury location.

- In Scenario 3, two conditions were examined. The first involved reclaiming the Thornbury Landfill and *not* landfilling the excavated landfill with waste such that there is no longer a source of leachate from the Thornbury Landfill. The second condition (3B) considered landfilling of the mined area with new municipal waste (*Note: lining of The Blue Mountains landfill is not possible during vertical expansion*)

1.1.1.3.4 Scenario 4 – Landfill Expansion Only

Scenario 4 is presented in Figure 11 and is based on the assumption that only an expansion of the Site will be undertaken. This expansion proposes the construction of a new cell outside the existing footprint identical to Scenario 1, as follows:

- Construction of a new landfill cell (Area 1 on Figure 11) to the north and west of the BML and Thornbury landfills, respectively, containing a total disposal capacity of 100,000 m³. This will increase the current waste disposal capacity of the Site from 370,000 m³ to 470,000 m³. The approximate dimensions of the new proposed cell are 170 m long by 100 m wide, with a fill depth of approximately 6 m below the existing grade. The completed cell will be at similar grades to the current design and will not change the Site profile as presented in the approved Design and Operations plan for the Site.
- Based on the Site's current waste disposal rate this expansion will provide the Town with approximately 10 years of additional disposal capacity.



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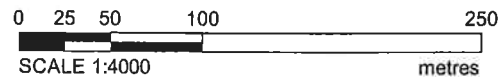
- SITE BOUNDARY
- - - APPROX. LIMIT OF LANDFILL
- - - ATTENUATION BOUNDARY
- SURFACE WATER
- △ SURFACE WATER SAMPLING LOCATION
- ⊕ EXISTING MONITORING WELL
- ⊕ ABANDONED MONITORING WELL
- PRIVATE WELL
- ▨ FINAL COVER
- ▨ ATTENUATION ZONE
- ▨ ACTIVE AREA

SCENARIO 1:

- 1 EXPANSION AREA
- 2 MINING AREA

REFERENCES:

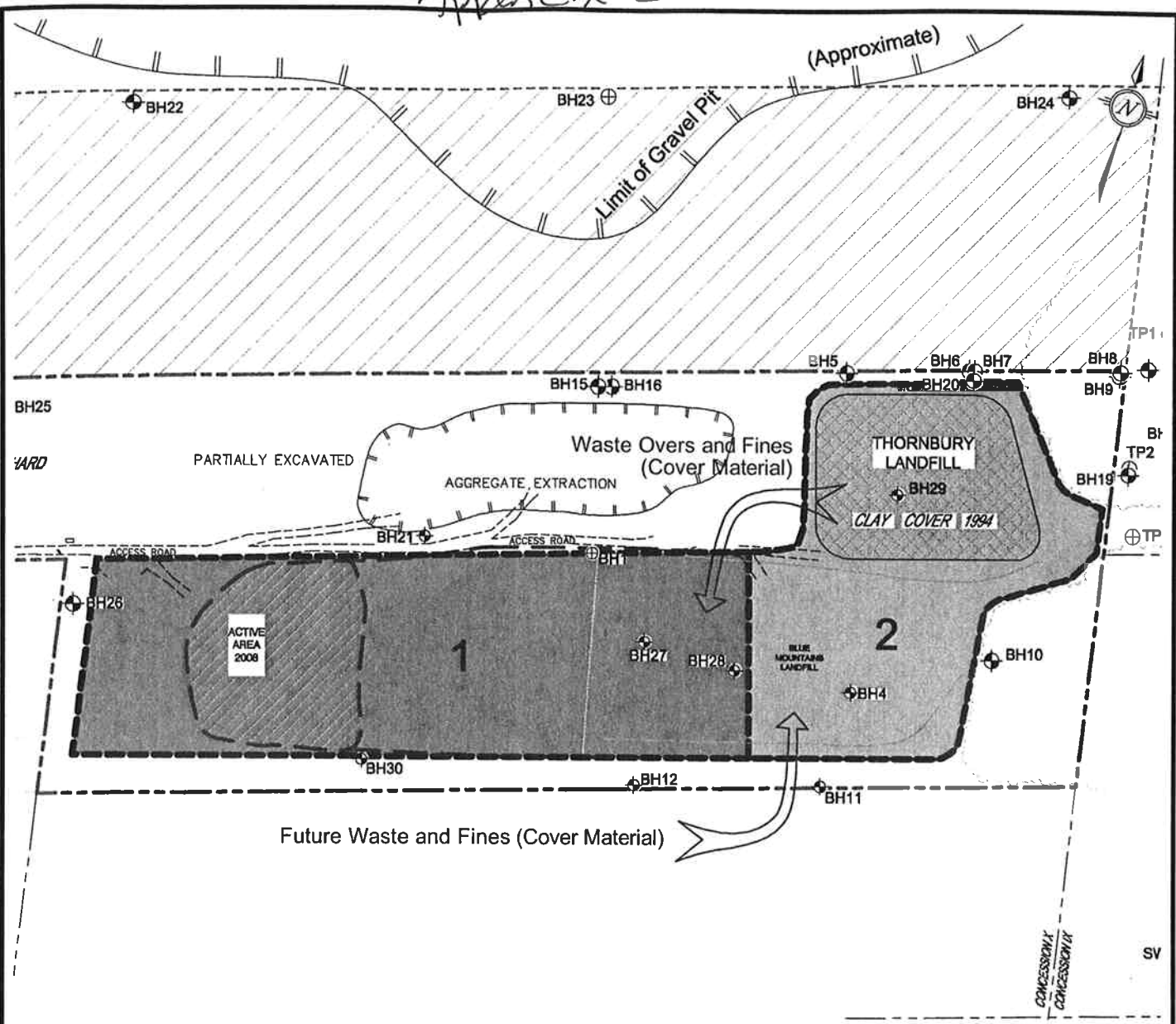
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2. STOCKPILE LOCATION & OTHER GENERAL FEATURES APPROXIMATE.



PLOT DATE: August 5, 2010
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<p>Golder Associates Barrie, Ontario, Canada</p>	SCALE AS SHOWN	TITLE	<h1>SCENARIO 1</h1> <p>THE BLUE MOUNTAINS LANDFILL MINING AND EXPANSION ENVIRONMENTAL SCREENING PROCESS</p>
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	CAD J REGIER		
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PROJECT No. 08-1182-0085	REV.		8

Appendix 2



LEGEND:

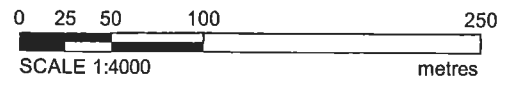
- SITE BOUNDARY
- - - APPROX. LIMIT OF LANDFILL
- - - ATTENUATION BOUNDARY
- SURFACE WATER
- △ SURFACE WATER SAMPLING LOCATION
- ⊕ EXISTING MONITORING WELL
- ⊕ ABANDONED MONITORING WELL
- PRIVATE WELL
- ▨ FINAL COVER
- ▨ ATTENUATION ZONE
- ▨ ACTIVE AREA

SCENARIO 1:

- 1 VERTICAL EXPANSION AREA
- 2 MINING AREA

REFERENCES:

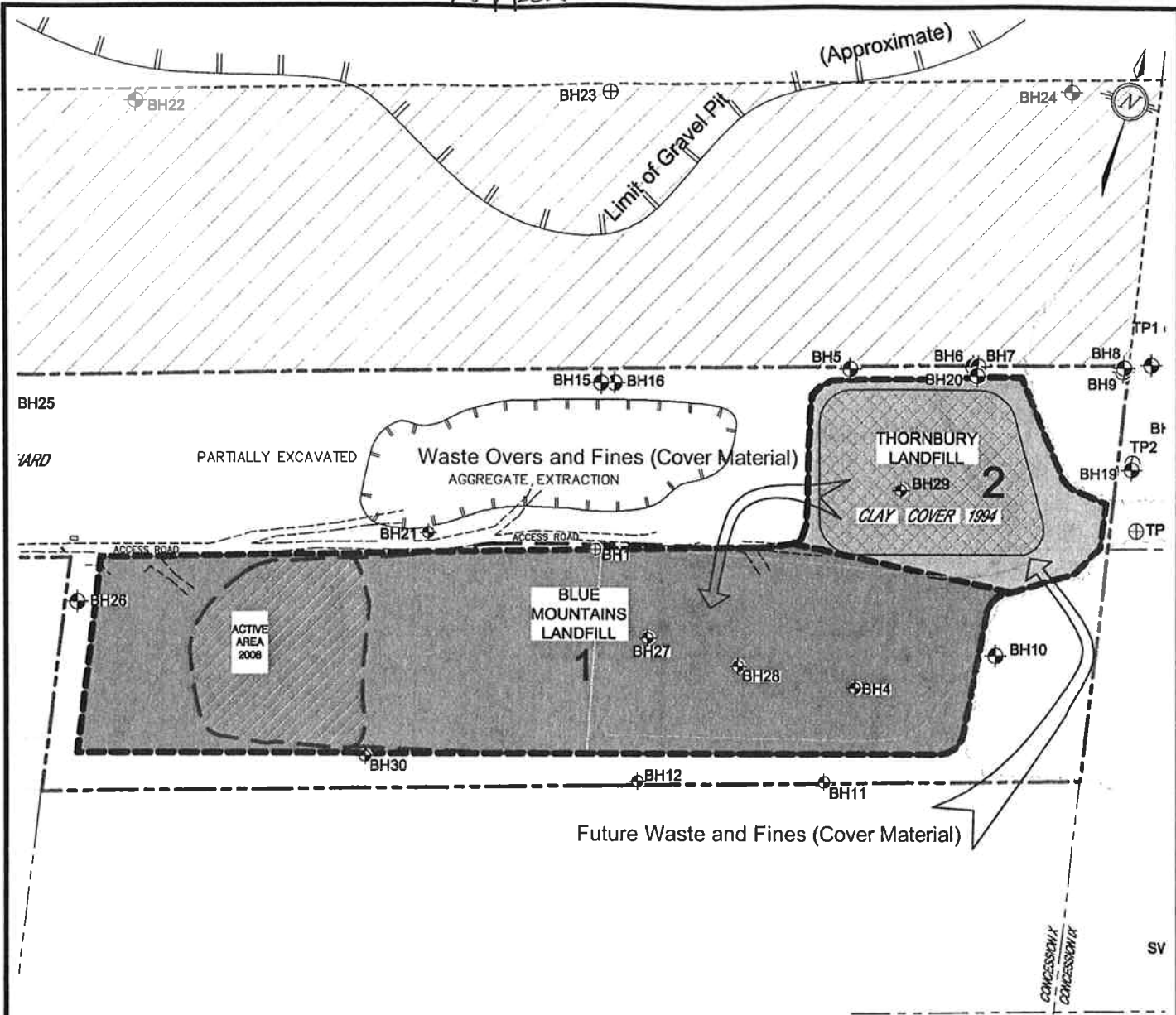
1. AutoCAD BASE COURTESY RJ BURNSIDE ASSOCIATES LTD. 2007
2. STOCKPILE LOCATION & OTHER GENERAL FEATURES APPROXIMATE.



PLOT DATE: August 5, 2010
FILENAME: T:\Projects\2008\08-1182-0085 (Blue Mountains Landfill Investigations)\-CC-\0811820085CCPLAN2.dwg

<p>Golder Associates Barrie, Ontario, Canada</p>	SCALE	AS SHOWN	<h1>SCENARIO 2</h1>
	DATE	05 AUG 2010	
	DESIGN		
	CAD	J REGIER	
FILE No.	0811820085CCPLAN2.dwg	CHECK	THE BLUE MOUNTAINS LANDFILL MINING AND EXPANSION ENVIRONMENTAL SCREENING PROCESS
PROJECT No.	08-1182-0085	REVIEW	

Appendix 2



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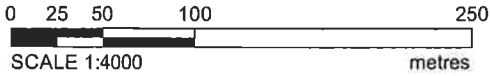
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- APPROX. LIMIT OF LANDFILL
- ATTENUATION BOUNDARY
- SURFACE WATER
- SURFACE WATER SAMPLING LOCATION
- EXISTING MONITORING WELL
- ABANDONED MONITORING WELL
- PRIVATE WELL
- FINAL COVER
- ATTENUATION ZONE
- ACTIVE AREA

SCENARIO 1:

- 1 VERTICAL EXPANSION AREA
- 2 MINING AREA

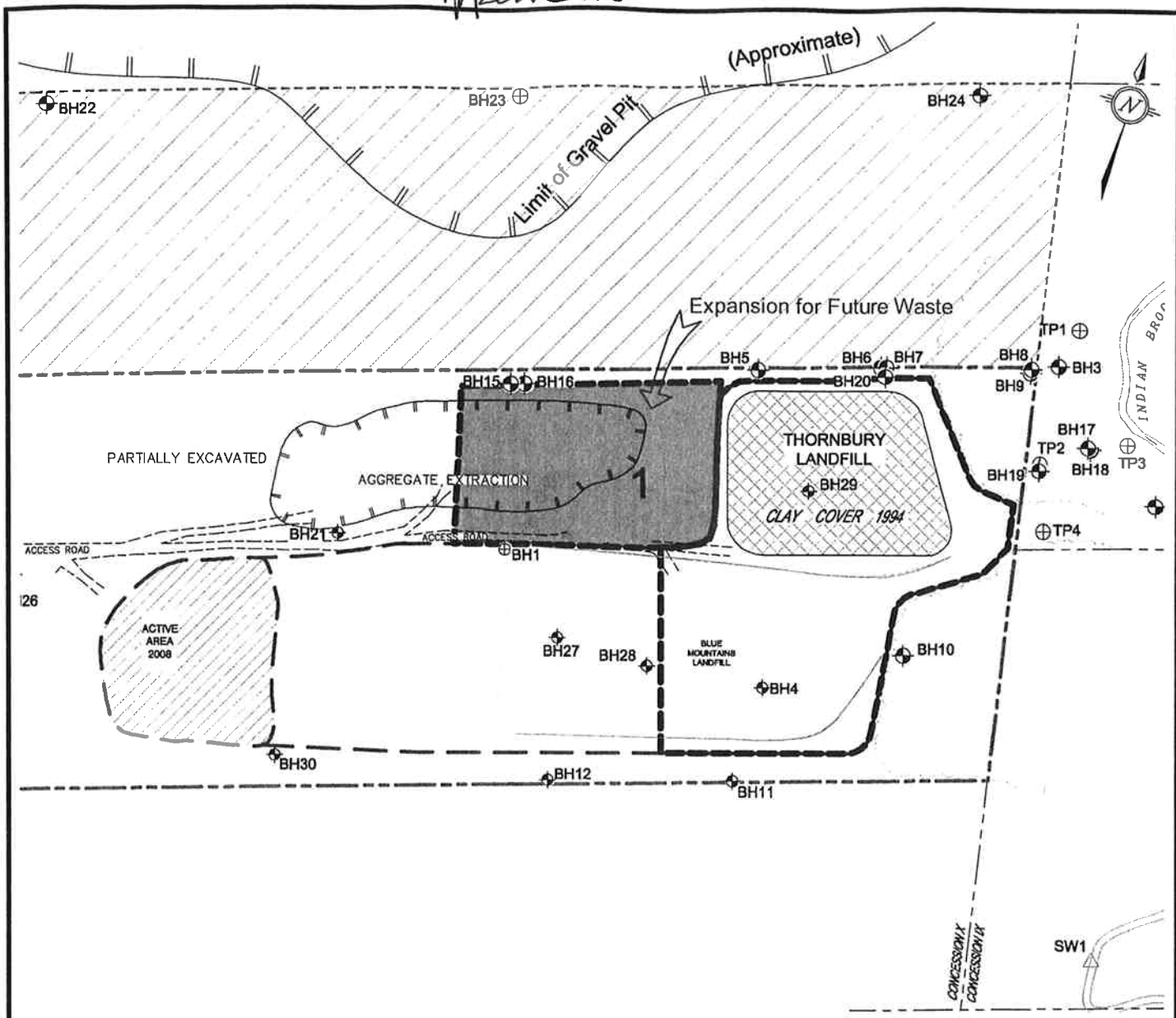
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1. AutoCAD BASE COURTESY R J BURNSIDE ASSOCIATES LTD. 2007
2. STOCKPILE LOCATION & OTHER GENERAL FEATURES APPROXIMATE.



PLOT DATE: August 5, 2010
 FILENAME: T:\Projects\2008\08-1182-0085 (Blue Mountains Landfill Investigations)\CC-0811820085CCPLAN3.dwg

<p>Golder Associates Barrie, Ontario, Canada</p>	SCALE AS SHOWN	TITLE	<h2>SCENARIO 3</h2>
	DATE 05 AUG 2010		
	DESIGN		
FILE No. 0811820085CCPLAN3.dwg	CAD J REGIER	<h3>THE BLUE MOUNTAINS LANDFILL MINING AND EXPANSION ENVIRONMENTAL SCREENING PROCESS</h3>	FIGURE 10
PROJECT No. 08-1182-0085	REV. REVIEW		



LEGEND:

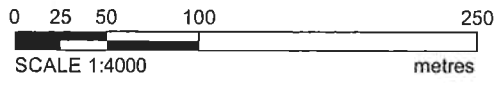
- SITE BOUNDARY
- APPROX. LIMIT OF LANDFILL
- ATTENUATION BOUNDARY
- SURFACE WATER
- SURFACE WATER SAMPLING LOCATION
- EXISTING MONITORING WELL
- ABANDONED MONITORING WELL
- PRIVATE WELL
- FINAL COVER
- ATTENUATION ZONE
- ACTIVE AREA

SCENARIO 1:



REFERENCES:

1. AutoCAD BASE COURTESY RJ BURNSIDE ASSOCIATES LTD. 2007
2. STOCKPILE LOCATION & OTHER GENERAL FEATURES APPROXIMATE.



PLOT DATE: August 5, 2010
FILENAME: T:\Projects\2008\08-1182-0085 (Blue Mountains Landfill Investigations)\-CC-0611820085CCPLAN4.dwg

<p>Golder Associates Barrie, Ontario, Canada</p>	SCALE	AS SHOWN	<p>SCENARIO 4</p> <p>THE BLUE MOUNTAINS LANDFILL MINING AND EXPANSION ENVIRONMENTAL SCREENING PROCESS</p>
	DATE	05 AUG 2010	
	DESIGN		
	CAD	J REGIER	
FILE No.	0811820085CCPLAN4.dwg	CHECK	<p>FIGURE 11</p>
PROJECT No.	08-1182-0085	REV.	

Appendix 3

EPW.10.091
 Attachment # 3

SCENARIO SUMMARY

The following tables provide a comparative summary of the four scenarios evaluated and described in this report.

Scenario Comparison

Scenario	Description	Expansion Volume (m ³)	Mining Volume (m ³)	Estimated Net Capacity Gain	Estimated Site Life	⁽¹⁾ Expansion Costs	Mining Costs	Re-Engineering Mined Cells	⁽²⁾ Allowance 12%	Total Estimated Costs	⁽³⁾ Construction Costs / Capacity Gain
Scenario 1	Northern Expansion and Mining of Thornbury & BML East	100,000	200,000	180,000 m ³	17 years	\$1,164,500	\$4,120,000	\$2,492,000	\$933,180	\$8,709,680	\$97 / tonne
Scenario 2	Vertical Expansion of BML and Mining of Thornbury & BML East	100,000	200,000	180,000 m ³	17 years	\$0	\$4,120,000	\$2,612,000	\$808,920	\$7,549,920	\$84 / tonne
Scenario 3	Vertical Expansion and Mining of only Thornbury	100,000	100,000	151,000 m ³	11 years	\$0	\$2,063,000	\$1,214,500	\$393,300	\$3,670,800	\$49 / tonne
Scenario 4	Northern Expansion	100,000		100,000 m ³	7 – 8 years	\$1,164,500	\$0	\$0	\$139,740	\$1,304,240	\$26 / tonne

⁽¹⁾ Costs reflect the construction of a composite liner and leachate collection system for all new cells and reclaimed cells based on modelling results.

⁽²⁾ Allowance is for Engineering Oversight, Material Testing, Liner QA/QC, etc. during landfill cell construction and mining process.

⁽³⁾ Excludes permitting and engineering and future landfill operational costs.

Scenario Leachate Generation and Treatment Cost Comparison

Scenario	Description	Collection Area m ²	Generation Rate m ³ /m ²	Annual Volume m ³	Transport Rate \$ / m ³	Transport Costs	Treatment Rate \$ / m ³	Treatment Costs	Total Annual Costs
Scenario 1	Pre-Landfill Closure	50,000	0.40	20,000	\$ 8.75	\$ 175,000	\$ 6.50	\$ 130,000	\$ 305,000
	Post Closure	50,000	0.24	12,000	\$ 8.75	\$ 105,000	\$ 6.50	\$ 78,000	\$ 183,000
Scenario 2	Pre-Landfill Closure	35,000	0.40	14,000	\$ 8.75	\$ 122,500	\$ 6.50	\$ 91,000	\$ 213,500
	Post Closure	35,000	0.24	8,400	\$ 8.75	\$ 73,500	\$ 6.50	\$ 54,600	\$ 128,100
Scenario 3 and 4	Pre-Landfill Closure	15,000	0.40	6,000	\$ 8.75	\$ 52,500	\$ 6.50	\$ 39,000	\$ 91,500
	Post Closure	15,000	0.24	3,600	\$ 8.75	\$ 31,500	\$ 6.50	\$ 23,400	\$ 54,900

APPENDIX 4

1.0 EVALUATION MATRIX

A comprehensive Evaluation Matrix was created comparing Scenarios 1 through 4 against the option of “Do Nothing”. A complete set of evaluation criteria was developed using the screening criteria checklist, defined in Step 3 of the Environmental Screening Process, and other key impact criteria such as cost, Site life, Site capacity and public acceptability.

The screening checklist criteria were identified as ‘risk’ criteria in the matrix and were assigned a risk score according to the following standardized risk formula:

$$\text{Risk} = \text{Probability (of the consequence)} \times \text{Consequence}$$

The probability of a consequence occurring is defined as the likelihood or chance that a negative end effect will be observed. Consequence is defined as the potential burden of a risk from an administrative, human health and/or environmental perspective.

For each risk item in question, both a probability and consequence score were assigned. The scoring system utilized is described in the tables below for probability and consequence scoring systems.

Probability Scoring System

Probability of the Consequence Occurring	Probability Value
Possible but Highly Unlikely	P = 0
Unlikely	P = 1
Possible	P = 2
Likely	P = 3
Almost Certain	P = 4

Consequence Scoring System

Consequence	Consequence Value
No Consequence	C = 0
Minor	C = 1
Medium	C = 2
Major	C = 3

The other impact criteria were assigned a weighted impact score according to the following formula:

$$\text{Weighted Impact} = \text{Weight} \times \text{Impact}$$

The overall risk/impact score for each scenario is summed in the final row of the Matrix, with higher scores representing a higher risk/impact.

Based on the Evaluation Matrix below and the scores presented within, Scenario 2 (i.e., Vertical Expansion and Mining of Thornbury/Blue Mountain) is identified as the preferred option for future expansion and mining of the Site.

APPENDIX 4

Evaluation Matrix

BLUE MOUNTAINS LANDFILL ESP EVALUATION MATRIX														
Assessment Criteria			Consequence Rating	Do Nothing		Scenario 1		Scenario 2		Scenario 3		Scenario 4		
				Prob-ability	Risk	Prob-ability	Risk	Prob-ability	Risk	Prob-ability	Risk	Prob-ability	Risk	
Risk Criteria (based on "Screening Criteria Checklist")	Surface and Ground Water	Negative effects on surface water quality, quantities or flow	2	2	4	1	2	1	2	1	2	1	2	
		Negative effects on ground water quality, quantity or movement	2	4	8	2	4	2	4	3	6	4	8	
		Significant sedimentation or soil erosion or shoreline or riverbank erosion on or off site	1	1	1	0	0	0	0	0	0	0	0	0
		Negative effects on surface or ground water from accidental spills or releases (e.g., leachate) to the environment	2	1	2	1	2	1	2	1	2	1	2	2
	Land	Negative effects on residential, commercial, institutional or other sensitive land uses within 500 metres from the site boundary	1	1	1	1	1	1	1	1	1	1	1	1
	Air and Noise	Negative effects on air quality due to emissions (e.g. temperature, nitrogen dioxide, sulphur dioxide, residual oxygen, opacity, hydrogen chloride, suspended particulates)	2	0	0	0	0	0	0	0	0	0	0	0
		Negative effects from the emission of greenhouse gases (e.g., carbon dioxide, carbon monoxide, methane)	1	4	4	4	4	4	4	4	4	4	4	4
		Negative effects from the emission of dust or odour	1	2										
		Negative effects from the emission of noise	1	2	2	3	3	3	3	3	3	2	2	2
		Light pollution from trucks or other operational activities at the site	1	2	2	3	3	3	3	3	3	2	2	2
	Natural Environment	Negative effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat	3	0	0	0	0	0	0	0	0	0	0	0
		Negative effects on protected natural areas or other significant natural areas	3	0	0	0	0	0	0	0	0	0	0	0
		Negative effects on designated wetlands	3	0	0	0	0	0	0	0	0	0	0	0
		Negative effects on wildlife habitat, populations, corridors or movement	3	0	0	0	0	0	0	0	0	0	0	0
		Negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)	3	0	0	0	0	0	0	0	0	0	0	0
		Negative effects on locally important or valued ecosystems or vegetation	3	0	0	0	0	0	0	0	0	0	0	0
		Increase bird hazards within the area that could impact surrounding land uses (e.g., airports)	1	0	0	0	0	0	0	0	0	0	0	0
	Resources	Negative effects on existing agricultural lands?	2	0	0	0	0	0	0	0	0	0	0	0
	Socio-economic	Negative effects on neighborhood or community character?	2	0	0	0	0	0	0	0	0	0	0	0
		Negative aesthetics impacts (e.g., visual and litter impacts)?												
Negative effects on local businesses, institutions or public facilities?		2	0	0	0	0	0	0	0	0	0	0	0	
Might the project cause negative effects on recreation, cottaging or tourism?		2	0	0	0	0	0	0	0	0	0	0	0	

APPENDIX 4

		Negative effects related to increases in the demands on community services and infrastructure?	1	0	0	0	0	0	0	0	0	0	0	
		Negative effects on the economic base of a municipality or community?	2	0	0	0	0	0	0	0	0	0	0	
		Negative effects on local employment and labour supply?	2	0	0	0	0	0	0	0	0	0	0	
		Negative effects related to traffic?	1	0	0	0	0	0	0	0	0	0	0	
		Interference with flight paths (i.e. construction of facilities with height)?	3	0	0	0	0	0	0	0	0	0	0	
		Might the project cause negative effects on public health and safety?	3	0	0	0	0	0	0	0	0	0	0	
	Heritage and Culture		Negative effects on heritage buildings, structures or sites, archaeological sites or areas of archaeological importance, or cultural heritage landscapes?	3	0	0	0	0	0	0	0	0	0	0
			Negative effects on scenic or aesthetically landscapes or views?	2	0	0	0	0	0	0	0	0	0	0
	First Nations		Negative effects on land, resources, traditional activities or other interests of First Nations communities?	3	0	0	0	0	0	0	0	0	0	0
		Risk Criteria Sub-Total				26		22		22		24		23
Other Impact Criteria			Weight	Impact	Weighted Impact*	Impact	Weighted Impact*	Impact	Weighted Impact*	Impact	Weighted Impact*	Impact	Weighted Impact*	
	Economic		Estimated Construction Costs (High,5 - Low, 0)	5	0	0	5	25	4	20	2	10	1	5
			Estimated Leachate Treatment Costs (High,5 - Low, 0)	5	1	5	5	25	3	15	2	10	2	10
			Estimated Annual Operational Costs (High,5 - Low, 0)	5	5	25	2	10	2	10	2	10	2	10
	Site Life		Additional Site Life (Short, 5 - long, 0)	5	5	25	0	0	0	0	3	15	4	20
	Site Capacity		Additional Site Capacity (Small, 5 - large, 0)	5	5	25	0	0	0	0	3	15	4	20
	Public Acceptability		Public Acceptability (To be based on public consultation)	5	3	15	3	15	3.0	15	3.0	15	3.0	15
	Other Impact Criteria Sub-Total				95		75		60		75		80	
OVERALL RISK/IMPACT SCORE (highest score = highest risk/impact)					121		97		82		99		103	

* Impact scores reflect the impact of each alternative in relation to the "Do Nothing (status quo)" option