TO: Interested Parties

RE: Elk River Landfill Expansion – Draft Environmental Impact Statement

The Minnesota Pollution Control Agency (MPCA) has prepared a Draft Environmental Impact Statement (EIS) on a proposal by Elk River Landfill, Inc. (ERL) to construct a horizontal landfill expansion at its existing site in the city of Elk River, Sherburne County. The Draft EIS is being distributed for public comment pursuant to Minn. R. 4410.2600, and will be on public notice until December 1, 2005. During that period, any person may provide comments on the Draft EIS to the MPCA.

The MPCA will conduct a public informational meeting on this Draft EIS. The public meeting will take place at the Uppertown Conference Room, 13065 Orono Parkway, Elk River, Minnesota, on Tuesday, November 15, 2005, from 6:30 p.m. to 8:30 p.m. Any person may appear and present comments during this meeting. Commenters are advised that all comments made in connection with this Draft EIS will become a part of the public record. A court reporter will be employed to provide a written record of meeting proceedings.

Your comments and questions on the Draft EIS are important to the completion of the Final EIS, the adequacy decisions to be made by the MPCA Citizens’ Board (Board), and to future permits that may be considered for this project. The MPCA will prepare written responses to your comments, and will revise the Draft EIS, if necessary, prior to the Board consideration of the Final EIS. All commenters will receive a copy of the Final EIS. All persons on the mailing list will be notified in advance of the Board adequacy decision meeting, and any person may appear at that meeting and address the Board if desired.

Printed copies of the Draft EIS are available for review at the Elk River Public Library, 413 Proctor Avenue, Elk River; the Great River Regional Library, 405 St. Germain, St. Cloud; the city of Elk River, 13065 Orono Parkway, Elk River; and the Sherburne County Government Center, 13880 Highway 10, Elk River, Minnesota. Printed copies are also available for review at the MPCA offices in Brainerd and St. Paul. A limited number of copies are available for public distribution. A full copy of the Draft EIS will be posted on the MPCA Web site at: http://www.pca.state.mn.us/news/eaw/index.html

Request for copies and written comments on the Draft EIS should be directed to Debra Moynihan, Project Manager, the MPCA Environmental Review and Operations Section, Regional Division, 520 Lafayette Road North, St. Paul, Minnesota 55155-4194.

If you have any questions regarding the project or the Draft EIS, please contact Debra Moynihan at (651) 296-8420.

Sincerely,

Richard Newquist
Supervisor, Environmental Review Unit
Environmental Review and Operations Section
Regional Division

Enclosure

RN:DM:nv
Abstract

Elk River Landfill (ERL), a wholly-owned subsidiary of Waste Management, Inc., owns and operates a Landfill under Minnesota Solid Waste Permit Number SW-74. ERL is also licensed and permitted by both Sherburne County and the City of Elk River. The Landfill is located 5 miles north of the City, along U.S. Highway 169 on 270 acres of land located in the NW ¼ of Section 3, T33N, R26W, and the SW ¼ of Section 34, T34N, R26W, Sherburne County, Minnesota. ERL is permitted to accept municipal solid waste (MSW), demolition and construction debris, yard waste for composting, industrial waste in accordance with a MPCA-approved Industrial Solid Waste Management Plan, and processing facility rejects from the Elk River Refuse Derived Fuel (RDF) facility. Elk River Landfill proposes to expand operations at its existing mixed MSW disposal facility by developing 73.7 acres currently used by a gravel mining operation located immediately south, adjacent to and as a contiguous part, of the existing Landfill property. The proposed landfill project, known as the Southern Development Area (SDA), will follow mining operations by the current property owner, the Tiller Corporation. The proposed project will provide approximately 15,000,000 cubic yards of additional MSW disposal capacity.
# Elk River Landfill Expansion

## Draft Environmental Impact Statement

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1 Summary

This EIS is being prepared by the Minnesota Pollution Control Agency (MPCA) based on a proposal by Elk River Landfill, Inc. (ERL) located in the city of Elk River, Sherburne County, Minnesota. ERL proposes to expand operations of its existing mixed municipal solid waste disposal facility to provide approximately 15,000,000 cubic yards of additional capacity and extend the operational life of the facility for 16 to 20 years, depending on incoming waste volumes.

This EIS is being prepared as a mandatory EIS under the requirements of Minn. R. 4410.4400, subp. 13(E) for expansion by 25 percent or more of a previous capacity of a mixed municipal solid waste disposal facility for 100,000 cubic yards or more of waste fill per year. The MPCA is the responsible governmental unit (RGU) for this EIS.

The purpose of the EIS is to evaluate and disclose information about the significant environmental effects of a proposed action. The EIS is not intended to justify either a positive or negative decision on a project, but may be utilized by governmental units as a guide in issuing or denying permits or approvals for the project and identifying measures necessary to avoid or mitigate adverse environmental effects.

The MPCA staff prepared a Scoping Environmental Assessment Worksheet (EAW) and Draft Scoping Decision Document on this proposed expansion project. The public comment period for the Scoping EAW and Draft Scoping Decision Document began on November 22, 2004. A public meeting was held in Elk River, Minnesota on December 9, 2004. The public comment period ended December 22, 2004. On January 25, 2005, the MPCA Citizens’ Board adopted a Final Scoping Decision Document for this EIS. An EIS Preparation Notice for the project was published in the Environmental Quality Board Monitor on June 20, 2005.

The MPCA is also the RGU responsible for the preparation of an EAW on the proposed expansion of the gas-to-energy recovery system, which is currently operated under a Title V permit issued by MPCA to the ERL. Landfill gas is collected and used to fuel three Caterpillar 3516 internal combustion engines (ICE) generator sets for generation of electricity that is distributed to homes in the city of Elk River through the local electric provider, Elk River Municipal Utilities. The volume of gas currently generated at the Landfill (i.e. without the proposed SDA) is such that there is sufficient gas generated to support the installation of a fourth ICE generator set. Under Minn. R. 4410.4300, subp. 15, the potential emissions increases from all four ICE generators combined trigger the mandatory threshold for completion of an EAW. Public notice of the EAW on this proposal is expected to occur in November, 2005.
1.1 Major Findings

1.1.1 Alternatives Analysis

The following findings were identified as part of the alternatives analysis that examined the impacts as a result of the “No Build” option where waste would be sent to solid waste management facilities other than the Elk River Landfill (ERL).

- Wastes being transported to one of the Designated Alternative Landfill Facilities (DALFs) would significantly reduce the life of the designated facility. This would result in significant local impacts on available disposal capacity at the DALFs.

- If the “No Build” option is selected, beneficial impacts include:
  - Increases in transfer haul employment due to the need for trucking to transfer the waste to the DALFs.
  - An increase in labor and equipment at the DALFs to dispose of the waste.
  - Potential lower costs to ERL users due to lower overall costs for transfer and disposal at the DALFs versus local disposal.

- If the “No Build” option is selected, adverse impacts include:
  - Lost employment at ERL.
  - The need to site, permit, and build a transfer station, with adequate capacity, at an estimated capital cost of $5 million.
  - Less than full use of potentially available airspace at ERL.
  - Increased air space consumption at the DALFs.
  - Loss of state and local tax and fee revenue as a result of no disposal at ERL.

1.1.2 Groundwater

The following findings were identified during the analysis of groundwater impacts:

- The Southern Development Area (SDA) has been adequately characterized and meets the requirements of applicable groundwater regulations.
- The hydrogeologic conditions at the site are suitable for development of the facility. Groundwater moves within a saturated unit (upper outwash) that is both well-defined and can be monitored to detect a potential release.
- The monitoring program will include lysimeter testing that would provide early warning of a release, should one occur. The groundwater monitoring well network is designed such that it includes numerous downgradient wells that are properly positioned to observe existing and future groundwater conditions at the site.
• The potential impact to downgradient receptors is low and monitoring of the nearest downgradient supply wells is part of the existing landfill sampling program.
• The potential for impact to Rice Lake/Tibbits Brook wetland complex is very low. Only a small portion of groundwater from the SDA can move to discharge at the wetland complex and the quality of this groundwater would be intercepted by one or more wells prior to reaching the wetland.

1.1.3 Surface Water

The following findings were identified in the surface water analysis for the proposed project at ERL:

• The drainage structure descriptions in the text portion of the Solid Waste Permit Application varies slightly from the drainage structure descriptions in the HydroCAD analysis. The descriptions should be consistent and will be addressed prior to issuance of the permit.
• The location and elevation of the outlet pipe from the wetland located at the southwest corner of the site and County Ditch 31 should be based upon a delineation of the wetland. The wetland should be delineated and the location and elevation of the outlet pipe should be designed so as not to affect the existing hydrology of the wetland nor excavate the wetland.
• The inlet and outlet locations for sedimentation basin P-1 should be reconfigured so that the flow path between them passes through the main treatment zone of the basin. In addition, the outlet from P-1 to the wetland should also be evaluated for the potential for erosion.

1.1.4 Air Quality

The following findings were identified in the air quality analysis for the proposed project at ERL:

• The maximum gas generation at ERL will significantly surpass the current collection and control system capacity. A proposed expansion of the existing collection and control system is included as part of landfill permitting.
• The proposed SDA has the potential to generate odors. Monitoring of emissions sources and the use of mitigative measures should continue to be employed at ERL.
1.1.5 Visual Impacts

The following findings were identified in the visual impacts analysis for the proposed project at ERL:

- The SDA can be effectively screened from Highway 169 by berms and trees.
- The SDA is effectively screened by existing trees along the corridor trail.
- There are limited opportunities to effectively screen the SDA from 221st Avenue vantage points.

1.1.6 Compatibility with Land Use

The following findings were identified in the compatibility with land use analysis for the proposed project at ERL:

- The proposed project is consistent with the Sherburne County Solid Waste Management Plan.
- An expansion of the Solid Waste Facility overlay will be required for zoning.
- The proposed project is compatible with existing and future land uses in the project area.
- A planned interchange at the intersection of Highway 169 and 221st Avenue may be impacted by the area proposed for the landfill expansion. Design of the interchange has not been completed so impacts cannot be quantified at this time.

1.1.7 Economic and Social Impacts

The following findings were identified in the economic and social impacts analysis for the proposed project at ERL:

- The transfer station capacity to transfer ERL waste to a DALF is not currently available. A risk of not having adequate transfer capacity is present should the “No Build” alternative be accepted.
- Significant revenues to the City, County, and State will be lost should the “No Build” alternative be accepted.
- Adverse impacts to existing or planned recreational resources are not anticipated.

1.2 Issues to be Resolved

The following issues will require resolution prior to permitting the proposed project.

- Discrepancies in the total waste volume used to predict landfill gas (LFG) emissions exist between permit application documents. Emissions estimates should be clarified during the solid waste and air permitting process and reflected in the LFG collection and control system design.
- The stormwater modeling and calculations needs further analysis to ensure adequacy before permitting.
1.3 Mitigation Measures

The following mitigation measures were identified as part of the environmental impact assessment:

- If the “No Build” option is selected, an additional study of impacts may be needed to better determine impacts associated with transfer station construction to transfer ERL wastes. Mitigation of potential impacts from the “No Build” option would be to allow the SDA to be constructed.
- Air quality impacts identified will be mitigated as part of permitting for the SDA LFG collection and control system.
- Stormwater impacts identified will be mitigated as part of permitting for the SDA.
- Adverse economic impacts were identified if the “No Build” option is selected. Mitigation of these impacts would be to allow the SDA to be constructed.
2 List of Preparers

The following McCain and Associates employees were primarily responsible for the preparation of the Elk River Landfill Southern Development Area Draft Environmental Impact Statement. Dahlgren, Shardlow, and Uban (DSU) was employed as a subcontractor to McCain and Associates. The list includes names and qualifications as follows:

<table>
<thead>
<tr>
<th>Company</th>
<th>Name, Formal Education</th>
<th>Professional Experience</th>
<th>Project Responsibilities</th>
</tr>
</thead>
<tbody>
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<td>John McCain, P.E. B.S. Civil Engineering</td>
<td>20 years experience in solid waste engineering and permitting</td>
<td>Overall Project Manager</td>
</tr>
<tr>
<td>McCain and Associates</td>
<td>Jim Aiken, P.G. M.S. Geology</td>
<td>18 years experience in hydrogeology and groundwater modeling</td>
<td>Hydrogeologist for Groundwater Section</td>
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<td>Angie Ronayne, PE B.S. Civil Engineering</td>
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<td>Engineering Technical Support for Primary Staff, Stormwater Impacts</td>
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<td>Data Imaging for Visual Impacts</td>
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<td>DSU</td>
<td>Thomas O’Neil Director of Market Research</td>
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<td>Ciara Schlichting AICP</td>
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<td>Social Impacts and Land Use</td>
</tr>
</tbody>
</table>
3 Project Description

Elk River Landfill (ERL), a wholly-owned subsidiary of Waste Management, Inc., owns and operates a Landfill under Minnesota Solid Waste Permit Number SW-74. ERL is also licensed and permitted by both Sherburne County and the City of Elk River. The Landfill is located 5 miles north of the City, along U.S. Highway 169 on 270 acres of land located in the NW ¼ of Section 3, T33N, R26W, and the SW ¼ of Section 34, T34N, R26W, Sherburne County, Minnesota (Figure 1). ERL is permitted to accept MSW, demolition and construction debris, yard waste for composting, industrial waste in accordance with a MPCA-approved Industrial Solid Waste Management Plan, and processing facility rejects from the Elk River Resource Recovery Facility facility.

Elk River Landfill proposes to expand operations at its existing mixed municipal solid waste (MSW) disposal facility by developing 73.7 acres currently used by a gravel mining operation located immediately south of the existing Landfill property. The proposed landfill project, known as the Southern Development Area (SDA), will follow behind mining operations by the current property owner, the Tiller Corporation.

The proposed SDA project will consist of approximately 73.7-acres of additional lined MSW Landfill area adjacent to, and integrated with, the currently permitted liner system at the ERL (Figure 2). The proposed SDA would include approximately 8.6 acres on the southern-most portion of the existing Landfill property and 65.1 acres extending onto the 109-acre parcel of property located immediately to the south of the existing Landfill. Development of the SDA would be integrated into the contours, general design and operation of the existing permitted Landfill.

The proposed SDA will provide approximately 15,000,000 cubic yards of additional MSW capacity over and above what was approved in the October 8, 2003, permit. Depending on waste flow quantities, this additional capacity would extend the operational life of the Landfill approximately 16 to 20 years, and provide long-term landfill capacity for the City, Sherburne County, and the surrounding area.

The proposed SDA will be developed in phases that minimize the size of the active area and allow efficient development of the permitted capacity.
## 4 Permits and Approvals

<table>
<thead>
<tr>
<th>Unit of Government</th>
<th>Type of Application</th>
<th>Status</th>
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<tbody>
<tr>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>Solid Waste Disposal Facility, SW-74, major modification and reissuance of permit.</td>
<td>Pending, application for major modification to Existing permit submitted.</td>
</tr>
<tr>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>Pollutant Discharge Elimination System (NPDES) General Stormwater Permit for Construction Activity</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>NPDES General Stormwater Permit for Industrial Activity, modification of permit.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>Minnesota Pollution Control Agency (MPCA)</td>
<td>Title V Air Permit, amendment of permit.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>Minnesota Office of Environmental Assistance (OEA)</td>
<td>Certificate of Need</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>Metropolitan Council Environmental Services (MCES)</td>
<td>Industrial Discharge Permit #2050, modification of permit for quantity limitations.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>Sherburne County</td>
<td>Solid Waste License, modification required.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>City of Elk River</td>
<td>Solid Waste License, new license required.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>City of Elk River</td>
<td>Conditional Use Permit; new Modified Conditional Use Permit (CUP) required.</td>
<td>To be submitted.</td>
</tr>
<tr>
<td>City of Elk River</td>
<td>Rezoning from Agricultural to Solid Waste Overlay District.</td>
<td>To be submitted.</td>
</tr>
</tbody>
</table>

It should be noted that mining activities on the proposed 109-acre SDA expansion area would continue to be operated under a Conditional Use Permit (CCU 02-30) issued by the City.
5 No Build Alternative

One of the main purposes of the EIS is to examine potential environmental impacts of project alternatives. The EQB rules require that an EIS include at least one alternative of each of the following types, or provide an explanation of why no alternative is included in the EIS: alternative sites, no action/no build, alternative technologies, modified designs or layouts, modified scale or magnitude, and alternatives incorporating reasonable mitigation measures identified through comments received during the EIS scoping and Draft EIS comment periods.

Alternatives may be eliminated during the scoping process if they meet the following criteria:

- Underlying need for or purpose of the project is not met.
- Significant environmental benefit over the proposed project is not provided.
- Another alternative is likely to be similar in environmental benefits but will have lesser socioeconomic impacts.

The Scoping Decision Document prepared for the proposed SDA project identified that the “no action/no build” alternative would be carried forward for further evaluation in the EIS. A summary of the alternatives that were eliminated from further discussion in the EIS can be found on pages 37 – 40 of the Scoping EAW.

This section addresses available options for MSW disposal in the event the expansion of the Elk River Landfill (ERL) does not occur and the waste currently being managed at ERL must be taken to another facility. This situation has been titled the “No Build” option.

5.1 Background

The MPCA and the OEA conducted an inventory of “available” solid waste management facilities that take MSW, MSW ash, and Refuse Derived Fuel ash in Minnesota, Wisconsin, North Dakota, and Iowa. The list of available facilities is limited to those facilities that are most likely to accept solid waste diverted from ERL if that landfill is not available. The following types of facilities were inventoried:

- solid waste composting;
- refuse-derived fuel;
- mass burn facilities
- private MSW landfills; and
- private industrial waste landfills
There are 12 different landfills and two resource recovery facilities included on this list. These 14 facilities comprise the available alternatives, referred to hereinafter as DALFs (Designated Alternative Landfills) and RRFs (Resource Recovery Facilities):

- Burnsville Sanitary Landfill, Waste Management Inc., Burnsville, MN
- Spruce Ridge Landfill, Waste Management Inc., Glencoe, MN
- Pine Bend Landfill, BFI/Allied, Inver Grove Heights, MN
- Forrest City Road Industrial Landfill, Onyx, Buffalo, MN
- SKB Rosemount Industrial Waste Landfill, SKB Environmental, Inc., Rosemount, MN
- Timberline Trail Recycling and Disposal Facility, Waste Management Inc. Weyerhaeuser, WI
- Seven Mile Creek Landfill, Onyx, Eau Claire, WI
- Sarona Landfill, BFI/Allied, Sarona, WI
- Central Disposal Landfill, Waste Management Inc., Lake Mills, IA
- Dickinson Landfill, Waste Management Inc., Spirit Lake, IA
- Jahner Landfill, Waste Management Inc., Wishek, ND
- Dakota Landfill, Waste Management Inc., Gwinner, ND
- Elk River Resource Recovery Facility, NRG Processing Solutions LLC, Elk River, MN
- Newport Resource Recovery Facility, NRG Processing Solutions LLC, Newport, MN

This section addresses the potential impact on each facility based on the following factors:

- Existing and future capacity
- Trucking requirements and impacts
- Economics of using each facility
- Environmental impacts at the facilities from accepting the ERL waste stream
- Employment changes caused by the “No Build” option on ERL and the receiving facility

In considering the “No Build” option the points listed below are to provide further clarification to specific issues with how the waste at ERL will be handled:

- ERL reported the following waste quantities were received in 2004:

  - MSW: 348,911 tons
  - Industrial Waste: 120,428 tons
  - Demolition/construction Waste: 107,597 tons
♦ The industrial waste stream can be further broken down to:

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>436 tons</td>
</tr>
<tr>
<td>Contaminated soil used as alternate cover material</td>
<td>112,886 tons</td>
</tr>
<tr>
<td>Other industrial wastes</td>
<td>7,106 tons</td>
</tr>
</tbody>
</table>

♦ If the SDA is not approved and the MSW landfill portion of the site is closed, the demolition/construction (dem/con) disposal portion will still be able to operate as permitted. Therefore, analysis of the dem/con portion of the waste stream is not part of this EIS.

♦ The dem/con disposal area of ERL is lined. Under the new MPCA Demolition Landfill Guidance (August 2005) it could be possible for the facility to request a modification to the Industrial Solid Waste Management Plan (ISWMP) to allow asbestos and most, if not all, of the contaminated soils to be placed in the dem/con disposal cell. Therefore, the EIS need only address 7,106 tons of miscellaneous industrial waste that would need to be transferred to another facility.

♦ The entire MSW waste stream currently going to ERL should be assumed to be redirected to the DALFs and RRFs on the inventory list provided by the MPCA. Of the 348,911 tons of MSW going to ERL approximately 191,089 tons of MSW comes directly from existing transfer stations and 52,394 tons are transferred from the Elk River RRF. This waste, if ERL were to close, is assumed to be transferred directly from the existing transfer stations to the DALFs and RRFs on the inventory list provided by the MPCA. The remaining MSW waste stream from ERL (105,428 tons) should be assumed to go from the proposed ERL transfer station (discussed below) to the DALFs and RRFs on the inventory list provided by the MPCA. If and when one of the facilities from the inventory list cannot accept all the waste, whether because of capacity or permit requirements regarding the type of wastes (i.e., municipal solid wastes cannot be accepted at an industrial waste landfill), the remaining wastes should be assumed to be handled at a single other facility. The facility is selected based on economic or environmental factors as appropriate.

♦ Because several of the DALFs are located a relatively great distance from ERL, the trucking cost analysis is assumed to include the construction and operation of a solid waste transfer station in the general vicinity of ERL. It is appropriate to use the assumption of the transfer station due to the distance to several of the alternatives, which would prohibit direct haul of solid waste. It is important to note that this assumption is made only for the purpose of completing the trucking analysis with assumptions typical in the solid waste industry. This analysis does not address whether the permitting and development of a solid waste transfer station could or should be completed in the vicinity of ERL. Such an analysis is beyond the scope of this EIS.
It was determined that the EIS would address the potential environmental impacts at each receiving facility as the potential impacts relate to the type of landfill liner in use at the facility, the potential for landfill gas (LFG) to be generated, and the overall use of the available disposal capacity.

Table 5-1 provides a summary of facility information, including facility name, address, owner, tons of wastes received, capacity, liner characteristics, distance from the ERL, tipping fees, and the number of employees. Some of the data used was provided by the MPCA/OEA. Other facility specific data were taken from the Environmental Impact Statement published for the Burnsville Sanitary Landfill Expansion Project 2005.

The capacity used per year at each facility was not available at all sites and/or not in uniform units of measurement. Some facilities provided the disposal tonnage for a specific year rather than the cubic yards of airspace used per year. This creates inconsistent calculations of the amount of airspace used per ton of waste. There were several facilities for which the reported disposal tonnage and cubic yards of airspace used per year were known to be for the same year. These had an average airspace utilization factor of approximately 0.75 tons per cubic yard of airspace. This airspace utilization factor is used herein to calculate the rate at which future airspace for each landfill receiving ERL waste would be consumed. A standard capacity utilization factor of 0.75 ton per cubic yard was used for each facility where the data were not consistent.

5.2 Capacity Issues

5.2.1 Resource Recovery Facilities

Both the Newport and Elk River RRFs have a permitted MSW processing capacity of 500,000 tons per year. However, effective processing capacity is limited by the combustion plant capacity at Red Wing, Wilmarth, and Elk River such that the realistic capacity is approximately 450,000 tons per year of MSW at each RRF. As shown in Table 5-1, each resource recovery facility receives approximately 434,000 tons of MSW per year. Additional capacity (both plants) would be 25,000 to 30,000 additional tons per year. Thus, for purposes of this analysis, each RRF will be assumed to receive 15,000 tons per year of MSW. The remaining waste is assumed to be transferred to one of the DALFs.

5.2.2 Designated Alternative Landfills

Starting with the assumption that 30,000 tons per year of MSW would be directed to RRFs (15,000 tons per year assumed available capacity at each facility), the remaining 318,911 tons per year of MSW and 7,106 tons per year of industrial waste would be directed to a DALF. Table 5-2 provides an analysis of the impact on the capacity and life expectancy of each DALF if the “No-Build” option were chosen. Table 5-2 lists for each DALF the location, owner, current waste volume received, permitted capacity, planned expansion capacity, and the effect on current and expansion capacities of receiving the ERL waste stream.
Table 5-1
Inventory of Designated Alternative Facilities

"No Build" Alternative Analysis

Elk River Landfill Environmental Impact Analysis

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Location</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSW Received (tpy)</td>
<td>348,911</td>
<td>270,202</td>
<td>126,022</td>
<td>229,418</td>
<td>0</td>
<td>0</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>432,861</td>
<td>435,012</td>
</tr>
<tr>
<td>IW Received (tpy)</td>
<td>120,428</td>
<td>94,126</td>
<td>34,522</td>
<td>74,556</td>
<td>294,906</td>
<td>274,108</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>432,861</td>
<td>435,012</td>
</tr>
<tr>
<td>Total Waste Received (tpy)</td>
<td>469,339</td>
<td>364,328</td>
<td>160,544</td>
<td>303,974</td>
<td>294,906</td>
<td>274,108</td>
<td>268,441</td>
<td>460,000</td>
<td>401,000</td>
<td>321,000</td>
<td>77,000</td>
<td>16,000</td>
<td>132,000</td>
<td>432,861</td>
<td>435,012</td>
</tr>
<tr>
<td>Capacity Used/Year (cy)</td>
<td>625,785</td>
<td>511,427</td>
<td>221,000</td>
<td>405,300</td>
<td>393,208</td>
<td>365,500</td>
<td>371,031</td>
<td>N.A.</td>
<td>673,693</td>
<td>200,000</td>
<td>180,000</td>
<td>25,000</td>
<td>265,000</td>
<td>432,861</td>
<td>435,012</td>
</tr>
<tr>
<td>Remaining Capacity (cy)</td>
<td>4,922,000</td>
<td>1,320,000</td>
<td>3,695,000</td>
<td>6,890,000</td>
<td>3,740,090</td>
<td>505,219</td>
<td>6,374,553</td>
<td>1,300,000</td>
<td>2,379,000</td>
<td>32,000,000</td>
<td>5,000,000</td>
<td>6,000,000</td>
<td>2,000,000</td>
<td>≈ 15,000 tpy</td>
<td>≈ 15,000 tpy</td>
</tr>
<tr>
<td>Known Future Expansion Plans (cy)</td>
<td>15,000,000</td>
<td>6,200,000</td>
<td>None</td>
<td>5,800,000</td>
<td>3,500,000</td>
<td>6,002,900</td>
<td>None</td>
<td>6,000,000</td>
<td>12,800,000</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>One-way Distance from ERL (miles)</td>
<td>N.A.</td>
<td>52</td>
<td>80</td>
<td>57</td>
<td>31</td>
<td>59</td>
<td>135</td>
<td>131</td>
<td>113</td>
<td>155</td>
<td>241</td>
<td>406</td>
<td>244</td>
<td>8</td>
<td>55</td>
</tr>
<tr>
<td>Tipping Fee ($/Ton)</td>
<td>$70.00</td>
<td>$63.00</td>
<td>$47.00</td>
<td>$68.00</td>
<td>$25.00</td>
<td>$75.00</td>
<td>$35.58</td>
<td>$47.25</td>
<td>$46.54</td>
<td>$49.06</td>
<td>$42.85</td>
<td>$32.00</td>
<td>$36.00</td>
<td>$45.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>No. of Employees</td>
<td>14</td>
<td>11</td>
<td>7</td>
<td>15</td>
<td>8</td>
<td>15</td>
<td>7</td>
<td>8</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

N.A. = Not Applicable.

SOURCES:
1 Burnsville Sanitary Landfill Expansion Project 2005, Final Environmental Impact Statement, May 2005, Minnesota Pollution Control Agency
2 Mileage as provided by query from Map Quest

P:\Projects\PCA\PCA0501\Alternatives\Table 5-1 Inventory of Designated Alternative Facilities.xls
## Table 5-2

### Capacity Analysis of Designated Alternative Landfills

#### "No Build" Alternative Analysis

#### Elk River Landfill Environmental Impact Analysis

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Burnsville Sanitary Landfill</th>
<th>Spruce Ridge Landfill</th>
<th>Pine Bend Landfill</th>
<th>Onyx FCR Industrial Landfill</th>
<th>SKB Rosemount Industrial Waste Landfill</th>
<th>Timberline Trail Recycling and Disposal Facility</th>
<th>Seven Mile Creek Landfill</th>
<th>Sarona Landfill</th>
<th>Central Disposal Landfill</th>
<th>Dickinson Landfill</th>
<th>Jahner Landfill</th>
<th>Dakota Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>2650 West Cliff Road</td>
<td>12755 137th St.</td>
<td>175 County Rd.</td>
<td>3425 Court House Blvd</td>
<td>13425 Courthouse Blvd</td>
<td>2495 117th St E.</td>
<td>8001 Olsen Dr.</td>
<td>W5967 County Highway D</td>
<td>21265 430th St.</td>
<td>7971 32 Ave. SE</td>
<td>7972 129 Ave. SE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burnsville, MN 55337</td>
<td>Glencoe, MN 55336</td>
<td>Buffalo, MN 55075</td>
<td>Rossumount, MN 55068</td>
<td>Hutchinson Blvd</td>
<td>Inver Grove Hts., MN 55075</td>
<td>Eau Claire, WI 54703</td>
<td>Eau Claire, WI 54703</td>
<td>Spirit Lake, IA 51360</td>
<td>SE, Wisconsin, ND 58495</td>
<td>SE, Gwinner, ND 58040</td>
<td></td>
</tr>
<tr>
<td><strong>Current Remaining Capacity (cy)</strong></td>
<td>1,320,000</td>
<td>3,695,000</td>
<td>6,890,000</td>
<td>3,740,090</td>
<td>6,508,119</td>
<td>6,374,553</td>
<td>1,300,000</td>
<td>2,379,000</td>
<td>32,000,000</td>
<td>5,000,000</td>
<td>6,000,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td><strong>Current Total Waste Received (tpy)</strong></td>
<td>364,328</td>
<td>160,544</td>
<td>303,974</td>
<td>294,906</td>
<td>268,441</td>
<td>460,000</td>
<td>401,000</td>
<td>401,000</td>
<td>321,000</td>
<td>77,000</td>
<td>16,000</td>
<td>132,000</td>
</tr>
<tr>
<td><strong>Current Remaining Life (yr)</strong></td>
<td>2.7</td>
<td>17.3</td>
<td>17.0</td>
<td>9.5</td>
<td>17.8</td>
<td>17.8</td>
<td>2.1</td>
<td>4.4</td>
<td>74.8</td>
<td>48.7</td>
<td>281.3</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Known Future Expansion Plans (cy)</strong></td>
<td>6,200,000</td>
<td>0</td>
<td>5,800,000</td>
<td>3,500,000</td>
<td>0</td>
<td>6,000,000</td>
<td>12,800,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Remaining Life with Expansion</strong></td>
<td>15.5</td>
<td>17.3</td>
<td>31.3</td>
<td>18.4</td>
<td>17.8</td>
<td>17.8</td>
<td>11.9</td>
<td>28.4</td>
<td>74.8</td>
<td>48.7</td>
<td>281.3</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>ERL MSW Transferred (tpy)</strong></td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>N/A</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
<td>318,911</td>
</tr>
<tr>
<td><strong>ERL Ind. Waste Transferred (tpy)</strong></td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
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<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
</tr>
<tr>
<td><strong>Total Waste Received with ERL Waste (tpy)</strong></td>
<td>690,345</td>
<td>486,561</td>
<td>629,991</td>
<td>302,012</td>
<td>281,214</td>
<td>594,458</td>
<td>786,017</td>
<td>727,017</td>
<td>647,017</td>
<td>403,017</td>
<td>342,017</td>
<td>458,017</td>
</tr>
<tr>
<td><strong>Capacity Used/Year with ERL Waste (cy)</strong></td>
<td>920,460</td>
<td>648,748</td>
<td>839,958</td>
<td>402,683</td>
<td>374,952</td>
<td>792,611</td>
<td>1,048,023</td>
<td>969,356</td>
<td>862,689</td>
<td>537,356</td>
<td>456,023</td>
<td>610,689</td>
</tr>
<tr>
<td><strong>Number of Years of Current Capacity Adding ERL Waste</strong></td>
<td>1.4</td>
<td>5.7</td>
<td>8.2</td>
<td>9.3</td>
<td>17.4</td>
<td>8.0</td>
<td>1.2</td>
<td>2.5</td>
<td>37.1</td>
<td>9.3</td>
<td>13.2</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Total Years of Permitted Capacity Adding ERL Wastes</strong></td>
<td>9.6</td>
<td>5.7</td>
<td>15.1</td>
<td>18.0</td>
<td>17.4</td>
<td>8.0</td>
<td>7.0</td>
<td>15.7</td>
<td>37.1</td>
<td>9.3</td>
<td>13.2</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Number of Years of Capacity with Expansion (Includes Current)</strong></td>
<td>8.2</td>
<td>5.7</td>
<td>15.1</td>
<td>18.0</td>
<td>17.4</td>
<td>8.0</td>
<td>7.0</td>
<td>15.7</td>
<td>37.1</td>
<td>9.3</td>
<td>13.2</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Percent Reduction in Permitted Life by Adding ERL Wastes</strong></td>
<td>13.4%</td>
<td>203.1%</td>
<td>58.2%</td>
<td>1.2%</td>
<td>2.6%</td>
<td>121.4%</td>
<td>12.6%</td>
<td>12.7%</td>
<td>101.6%</td>
<td>423.4%</td>
<td>2037.6%</td>
<td>247.0%</td>
</tr>
<tr>
<td><strong>Percent Reduction in Total Life by Adding ERL Wastes</strong></td>
<td>38.0%</td>
<td>67.0%</td>
<td>51.7%</td>
<td>2.4%</td>
<td>2.5%</td>
<td>54.8%</td>
<td>41.5%</td>
<td>44.8%</td>
<td>50.4%</td>
<td>80.9%</td>
<td>95.3%</td>
<td>71.2%</td>
</tr>
</tbody>
</table>

**SOURCE:**

1 Burnsville Sanitary Landfill Expansion Project 2005, Final Environmental Impact Statement, May 2005, Minnesota Pollution Control Agency

P:\Projects\PCA\PCA0501\Alternatives\Table 5-2 Capacity Analysis.xls
Based upon the analysis presented in Table 5-2, the following conclusions can be drawn:

- ERL currently manages about 41% of the waste delivered to metro-area landfills (ERL, Burnsville Sanitary Landfill, and Pine Bend Landfill).
- Delivery of the ERL waste stream to the other metro landfills would exhaust the permitted metro capacity in about 8 years (vs. 12 years without ERL waste), and would exhaust the permitted-plus-expansion metro capacity in about 20 years (vs. 30 years without ERL waste).
- The annual volume of ERL waste to be directed to other landfills represents over 10% of the total annual waste volume already received by all 12 DALFs.
- The total waste volume that would be managed by the ERL expansion represents over 18% of the total permitted capacity of the 12 DALFs, and over 12% of the total permitted-plus-expansion capacity of the 12 DALFs.
- The ERL industrial waste stream can be readily accommodated by those DALFs that accept only industrial waste (Onyx FCR and SKB).
- Central Disposal Systems is the only one of the DALFs that can manage both its own current waste stream and the ERL waste stream over the projected life of the ERL expansion.
- The addition of the ERL waste stream would completely exhaust the current capacity of any single DALF, with the exception of Central Disposal Systems, in one to 13 years, with an average of 6 years.
- The addition of the ERL waste stream would completely exhaust the permitted-plus-expansion capacity of any single DALF, with the exception of Central Disposal Systems, in 3 to 15 years, with an average of about 8 years. The ability of those DALFs with expansion plans to obtain permits for expansion is not known.

If the “No Build” option were to occur, there would be significant local impacts on available waste disposal capacity.

5.3 Trucking Requirements and Impacts

The waste stream currently delivered to ERL is comprised of 105,428 tons per year direct-hauled MSW, 243,483 tons per year transfer-hauled MSW (from existing transfer stations and RRF’s), and 7,106 tons per year direct-hauled industrial waste. For purposes of calculating the transportation costs associated with the No-Build Alternative, the following assumptions are made:

- 15,000 tons per year MSW that is currently direct-hauled to ERL will instead be direct-hauled to the Elk River Resource Recovery Facility at zero incremental cost, since the Elk River RRF is within the same local service area as ERL (discussed in Section 5.2.1).
• A transfer station will be constructed in the vicinity of ERL that will manage 90,428 tons per year MSW (105,428 tons – 15,000 tons = 90,428 tons) and 7,106 tons per year industrial waste (375 tons per day, 5 days per week).
• 90,428 tons per year MSW (105,428 tons – 15,000 tons = 90,428 tons) and 7,106 tons per year industrial waste will be transfer-hauled to the DALFs.
• 15,021 tons per year MSW that is currently transfer-hauled to ERL will instead be transfer-hauled to the Newport Resource Recovery Facility at zero incremental cost. The Brooklyn Park transfer station managed 15,021 tons in 2004. The travel distance to Newport is about 10 miles farther than to Elk River under arguably different traffic conditions, but the incremental cost is negligible relative to the long-distance hauling to most of the DALFs, especially considering the relatively small amount of waste managed.
• 52,394 tons per year of non-processed MSW and residual waste are delivered to the ERL from the NRG Energy Elk River RDF.
• 191,089 tons per year MSW already transfer-hauled to ERL will instead be transfer hauled to the DALFs.

The following sections discuss the costs associated with directing the ERL waste stream to the DALFs and RRFs as described above.

5.3.1 Proposed Transfer Station Costs
An important economic aspect of the “No-Build” Option is the cost of transporting the wastes from the ERL to any of the DALFs. It is assumed that a transfer station would be utilized for this purpose because the hauling distance to the DALFs would preclude direct-haul by waste collection vehicles. Twelve of the DALFs are over 50 miles from ERL of which seven are over 100 miles from ERL. The furthest facility is 406 miles from the ERL. Therefore the only realistic method for transporting waste to these alternative facilities is via transfer hauling. It is important to note that no analysis of the ability to site and permit such a transfer station is included in this EIS.

The tonnage assumed to be handled at the transfer station is 97,534 tons per year (112,534 tons per year currently being delivered to ERL less 15,000 tons per year to be direct-hauled to the Elk River RRF). Based on a five-day-per-week schedule, approximately 375 tons of waste per day is delivered to the ERL. The transfer station would need to be capable of accommodating peak tonnages expected at different times of the year.

Calculating detailed cost estimates for constructing and operating a transfer station at the ERL is beyond the scope of this EIS. However, a preliminary cost estimate was prepared for the Burnsville Sanitary Landfill EIS. That data is presented here (Waste Management has indicated that capitol and operating costs of a 500 ton per day facility are similar to that of a 1,200 ton per day facility as proposed in the Burnsville Sanitary Landfill EIS). The capital cost for a transfer station capable of handling approximately 375 tons per day was estimated to be $4 to $6 million. For purposes of this analysis, a capital cost estimate of $5 million will be used. This is assumed to cover the cost of land, permitting,
engineering, site development, and building construction. The debt service for this capital project is $2 per ton of waste. The cost to operate and maintain the transfer station was estimated at $5 to $7 per ton. For purposes of this analysis, a cost of $6 per ton will be used as the cost to operate the transfer station. Therefore, the total capital and operating costs for the transfer station are $8 per ton, or $2,607,392 per year ($2 per ton debt service plus $6 per ton operating cost times 325,924 tons per year).

5.3.2 Transfer-Hauling Costs

The cost associated with hauling the waste depends on several variables, including distance to the site, average speed of the transfer vehicle, labor costs, and fuel costs. Industry averages have been used to develop estimates of the “cost per ton-mile” to transfer haul the wastes.

In concurrence with industry averages, the cost per mile to own and operate the transfer tractor (including the equipment, labor, fuel, and maintenance) ranges from $1.25 to 1.50 per mile. The average weight per load for a transfer trailer ranges from 18 to 20 tons per load. Using this data, the average “cost per ton-mile” ranges from 6.25 cents to 8.33 cents (i.e., $1.25/20 ton-miles and $1.50/18 ton-miles respectively).

One of the most critical variables affecting the cost per ton-mile is the overall distance traveled to the site and the type of roads available. The longer the haul, the lower the unit cost per mile. The amount of stop and go highway traffic versus Interstate Highways also affects this. For purposes of this analysis, a cost of 8.33 cents per ton-mile is used to estimate the transfer haul cost to the DALFs that are less than 25 miles from the Landfill. For the DALFs that are more than 26 miles but less than 100 miles, a cost per ton-mile of 7.5 cents is used. For locations over 101 miles, a cost per ton-mile of 6.25 cents is used. These values are used to approximate the improved economies of scale of distance and take into account the local highway traffic.

Tables 5-3A and 5-3B present the incremental transfer-hauling cost estimates to each DALF from the proposed Elk River transfer station and the existing transfer stations, respectively. The tables incorporate the per-mile hauling cost, the tipping fee, and the capital and operating costs for the proposed Elk River transfer station, all on a per-ton basis. Note that the tables use the differential mileage to each DALF relative to ERL and the differential tipping fee at each DALF relative to ERL. The result is a comparison of the direct economic effect of the No-Build Alternative to the proposed project.

The primary variables in this comparison that affect the Total Annual Costs are the tipping fee and the total distance to the DALF. It should be noted that not all users pay the gate rates at any particular facility. The posted gate rate at a DALF is that rate paid by individual self haulers. There are often contract rates for volume users.

The posted gate rate includes taxes paid to the State of Minnesota (State Solid Waste Tax). Commercial and residential wastes are taxed at different rates (17% and 9.75%, respectively). Self haulers pay this tax at the time of disposal (at the landfill gate). Large
## Table 5-3A

Transfer Haul Cost Estimates

"No Build" Alternatives Analysis

Elk River Landfill Environmental Impact Analysis

<table>
<thead>
<tr>
<th>Location</th>
<th>Burnsville Sanitary Landfill</th>
<th>Spruce Ridge Landfill</th>
<th>Pine Bend Landfill</th>
<th>Onyx FCR Industrial Landfill</th>
<th>SKB Rosemount Industrial Waste Landfill</th>
<th>Timberline Trail Recycling and Disposal Facility</th>
<th>Seven Mile Creek Landfill</th>
<th>Sarona Landfill</th>
<th>Central Disposal Landfill</th>
<th>Dickinson Landfill</th>
<th>Jahner Landfill</th>
<th>Dakota Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Name</td>
<td>Burnsville</td>
<td>Spruce Ridge</td>
<td>Pine Bend</td>
<td>Onyx FCR</td>
<td>SKB Rosemount</td>
<td>Timberline Trail</td>
<td>Seven Mile</td>
<td>Sarona</td>
<td>Central</td>
<td>Dickinson</td>
<td>Jahner</td>
<td>Dakota</td>
</tr>
<tr>
<td>MSW Transferred (tpy)</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>0</td>
<td>0</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
</tr>
<tr>
<td>IW Transferred (tpy)</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
</tr>
<tr>
<td>Total Waste Transferred (tpy)</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>7,106</td>
<td>7,106</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
</tr>
<tr>
<td>One-way Distance from ERL (miles)</td>
<td>53</td>
<td>80</td>
<td>57</td>
<td>31</td>
<td>59</td>
<td>135</td>
<td>131</td>
<td>113</td>
<td>155</td>
<td>241</td>
<td>406</td>
<td>244</td>
</tr>
<tr>
<td>Assumed Cost/Ton-mile</td>
<td>$0.075</td>
<td>$0.075</td>
<td>$0.075</td>
<td>$0.075</td>
<td>$0.075</td>
<td>$0.0625</td>
<td>$0.0625</td>
<td>$0.0625</td>
<td>$0.0625</td>
<td>$0.0625</td>
<td>$0.0625</td>
<td>$0.0625</td>
</tr>
<tr>
<td>Hauling Cost Per Year</td>
<td>$775,395</td>
<td>$1,170,408</td>
<td>$833,916</td>
<td>$33,043</td>
<td>$62,888</td>
<td>$1,645,866</td>
<td>$1,597,119</td>
<td>$1,377,668</td>
<td>$1,889,721</td>
<td>$2,938,212</td>
<td>$4,949,851</td>
<td>$2,974,787</td>
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<tr>
<td>Transfer Station ¹</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>83,060</td>
<td>83,060</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
<td>2,727,392</td>
</tr>
<tr>
<td>Tipping Fee (&quot;Gate Rate&quot; in $/Ton)</td>
<td>$63.00</td>
<td>$47.00</td>
<td>$68.00</td>
<td>$25.00</td>
<td>$75.00</td>
<td>$35.58</td>
<td>$47.25</td>
<td>$46.54</td>
<td>$49.06</td>
<td>$42.85</td>
<td>$32.00</td>
<td>$36.00</td>
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<tr>
<td>Differential Tipping Fee ²</td>
<td>-$7.00</td>
<td>-$23.00</td>
<td>-$2.00</td>
<td>-$45.00</td>
<td>$5.00</td>
<td>-$34.42</td>
<td>-$10.75</td>
<td>-$11.46</td>
<td>-$8.94</td>
<td>-$15.15</td>
<td>-$26.00</td>
<td>-$22.00</td>
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<tr>
<td>Annual Cost to Transfer Haul</td>
<td>$92,657</td>
<td>($1,072,874)</td>
<td>$638,848</td>
<td>($286,727)</td>
<td>$98,418</td>
<td>($1,711,234)</td>
<td>$548,629</td>
<td>$259,928</td>
<td>$1,017,767</td>
<td>$1,460,572</td>
<td>$2,413,967</td>
<td>$829,039</td>
</tr>
</tbody>
</table>

¹ Based on an average O&M cost of $6 per ton and a debt service cost of $2 per ton.
² Tipping Fee at ERL is $70.00
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>10633 89th Ave N</td>
<td>Elk River, MN 55320</td>
<td>10533 89th Ave N Maple Grove, MN 55369</td>
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</tr>
<tr>
<td>MSW Transferred (tpy)</td>
<td>11,784</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>One-way To Transfer, Mileage</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>One-way Distance to Facility</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assumed Cost/ton-mile</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Cost</td>
<td>Tipping Fee (&quot;Gate Fee&quot; in $/ton)</td>
<td>Total</td>
<td>Tipping Fee</td>
<td>Annual Cost</td>
<td>Tipping Fee (&quot;Gate Fee&quot; in $/ton)</td>
</tr>
<tr>
<td>Waste Management - Blaine Transfer Facility</td>
<td>185</td>
<td></td>
<td></td>
<td>4.50</td>
<td>$16,460</td>
</tr>
<tr>
<td>Waste Management - RE-CY-Co Transfer Facility</td>
<td>185</td>
<td></td>
<td></td>
<td>4.50</td>
<td>$16,460</td>
</tr>
<tr>
<td>NRG Energy Inc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste Management - Maple Grove Transfer Facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P:\Projects\PCA\PCA0501\Alternatives\Table 5-3B Existing Transfer Stations Alternative Facility
volume haulers pay this tax directly to the state. The tipping fee used in this analysis is derived by deducting an average tax rate of 13% from the posted gate rate.

Table 5-3C summarizes the lowest cost DALF for each existing transfer station.

Table 5—3C Summary of Existing Transfer Stations Alternative Facility

<table>
<thead>
<tr>
<th>Existing Transfer Station</th>
<th>Selected Alternative Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brooklyn Park Recycling Ctr. &amp; Transfer, Brooklyn Park, MN</td>
<td>Newport Resource Recovery Facility</td>
</tr>
<tr>
<td>Bueckers City Sanitation Service Inc., Long Prairie, MN</td>
<td>Dakota Landfill</td>
</tr>
<tr>
<td>Cass County Pine River Transfer Station, Pine River, MN</td>
<td>Dakota Landfill</td>
</tr>
<tr>
<td>Elk River Resource Recovery Facility, Elk River, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Garrison Disposal Transfer Facility, Aitkin, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>McGregor Area Transfer Station, McGregor, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Meeker County Transfer Station, Litchfield, MN</td>
<td>Spruce Ridge Landfill</td>
</tr>
<tr>
<td>Philips Recycling and Transfer Facility, St. Cloud, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Todd County Transfer Station, Long Prairie, MN</td>
<td>Dakota Landfill</td>
</tr>
<tr>
<td>Waste Management Bellaire Transfer Facility, Blaine, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Waste Management Blaine Transfer Facility, Blaine, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Waste Management Maple Grove Transfer Facility, Maple Grove, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Waste Management RE-CY-CO Transfer, Blaine, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Waste Management St. Cloud Transfer Facility, St. Cloud, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
<tr>
<td>Waste Management Zenith Kramer Transfer Facility, Cohasset, MN</td>
<td>Timberline Trail Recycling and Disposal Facility</td>
</tr>
</tbody>
</table>

5.4 Economic Impacts of Employment Changes

This section analyzes the potential economic impact relating to employment changes that could occur as a result of the “No-Build” Alternative.
5.4.1 Employment and Economic Impact at ERL

Waste Management Inc. reports that there are 14 employees currently employed by ERL, with a total annual payroll of $607,500 (excluding benefits). These employees and payroll would be terminated in the “No-Build” Alternative.

5.4.2 Transfer Station/Transfer Haul Employment and Economic Impact

The Trucking Cost Analysis in Section 5.3 assumes that a transfer station would be sited, permitted, and operated to receive and transfer the wastes currently being delivered to the ERL. The capital and operating costs were reported in Section 5.3 to be approximately $5 million in capital and approximately $2,100,000 per year for operations and maintenance per year. The employment assumptions at the transfer station include up to 3 people employed at approximately $30 per hour (including benefits) for a total employment economic impact of approximately $187,500 per year.

Use of DALFs rather than ERL for waste disposal will result in employment impacts due to the increased hauling distance. The analysis in Table 5-4 shows the number of driver employees and the drive labor cost associated with each DALF. Factors used in the analysis include tons of waste per truck, resultant number of trips, average effective driving speed based upon distance (45 mph for 25 miles or less, 55 mph for 26 to 99 miles, and 60 mph for 100 miles or more), and loading/unloading time. Each driver is allowed 2,000 working hours per year. The cost of $60,000 per driver per year was an estimate provided by Waste Management, Inc.

The results indicate a range of 6 to 36 drivers required depending upon the distance to the DALF. The employment cost range varied from a low of $373,803 per year to a high of $2,161,148 per year. The cost of this new employment is accounted for in the “cost per mile” in Table 5-3A and 5-3B, but is reported separately here to distinguish the impact of the employment changes.

5.4.3 Employment and Economic Impact on Facility Operations

Additional labor and equipment will be required at the DALFs in order to handle the average 1,350 tons per day of waste. In general, landfill compactors expected to be used for operations of this size can handle approximately 550 tons per day. Therefore, an additional three compactors are needed to properly handle the approximately 1,350 tons per day. There would also be a need for an additional dozer, an additional truck scale, and associated miscellaneous equipment. Table 5-5 provides an estimate of the cost of the additional equipment and facilities. The additional equipment and facility capital cost would be amortized in the increased tipping fee revenue received at each facility.
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>26650 West Cliff Road, Burnsville, MN 55337</td>
<td>12755 137th St., Glencoe, MN 55336</td>
<td>2495 117th St. E., Inver Grove Hts., MN 55075</td>
<td>175 County Rd. 37NE, Buffalo, MN 55075</td>
<td>13425 Courthouse Blvd, Rosemount, MN 55068</td>
<td>8001 Olson Dr., Eau Claire, WI 54703</td>
<td>W 5987 County Highway D, Sarona, WI 54870</td>
<td>21265 430th St., Lake Mills, IA 50450</td>
<td>2575 190th St., Spirit Lake, IA 51360</td>
<td>7971 32 Ave. SE, Wishek, ND 58495</td>
<td>7972 129 Ave. SE, Gwinner, ND 58040</td>
<td>10700 165 Ave. NW, Elk River, MN 55330</td>
<td>2901 Maxwell Ave., Newport, MN 55055</td>
<td></td>
</tr>
<tr>
<td>MSW Transferred (tpy)</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
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<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>15,000</td>
<td>15,000</td>
</tr>
<tr>
<td>IW Transferred (tpy)</td>
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<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
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<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Waste Transferred (tpy)</td>
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<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
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<td>19</td>
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<td>19</td>
<td>19</td>
<td>19</td>
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<tr>
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<td>5,133</td>
<td>5,133</td>
<td>5,133</td>
<td>5,133</td>
<td>789</td>
<td>789</td>
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<tr>
<td>One-way Distance from ERL (miles)</td>
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<td>80</td>
<td>57</td>
<td>31</td>
<td>59</td>
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<td>131</td>
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<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>Hours per Trip (incl. 1/2 hour unloading)</td>
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<td>3.4</td>
<td>2.6</td>
<td>1.6</td>
<td>2.6</td>
<td>5.0</td>
<td>4.9</td>
<td>4.3</td>
<td>5.7</td>
<td>8.5</td>
<td>14.0</td>
<td>8.6</td>
<td>0.9</td>
<td>2.5</td>
</tr>
<tr>
<td>Trips per Driver per Year (at 2,000 hrs/yr.)</td>
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<td>587</td>
<td>777</td>
<td>1,229</td>
<td>756</td>
<td>400</td>
<td>411</td>
<td>469</td>
<td>353</td>
<td>234</td>
<td>143</td>
<td>232</td>
<td>2,338</td>
<td>800</td>
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<tr>
<td>Number of Drivers Required</td>
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<td>9</td>
<td>7</td>
<td>0</td>
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<td>12</td>
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<td>36</td>
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<td>1</td>
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<tr>
<td>Cost per Driver per Year</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Driver Labor Cost per Year</td>
<td>$373,803</td>
<td>$525,004</td>
<td>$396,203</td>
<td>$18,258</td>
<td>$29,682</td>
<td>$770,005</td>
<td>$749,472</td>
<td>$657,071</td>
<td>$872,673</td>
<td>$1,314,142</td>
<td>$2,161,148</td>
<td>$1,329,542</td>
<td>$20,263</td>
<td>$59,211</td>
</tr>
</tbody>
</table>

Note: Any value of 0 for Number of Drivers Required indicates that one part time driver would suffice.
Table 5-5  Additional Equipment Required

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Capital Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compactors</td>
<td>3</td>
<td>$2,025,000</td>
</tr>
<tr>
<td>Dozer</td>
<td>1</td>
<td>470,000</td>
</tr>
<tr>
<td>Scale</td>
<td>1</td>
<td>60,000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>--</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>--</td>
<td><strong>$2,605,000</strong></td>
</tr>
</tbody>
</table>

There will also be an associated increase in the labor required to operate the equipment noted above (total of four equipment operators for three compactors, and a dozer), as well as an additional maintenance mechanic, a general laborer, and a scale operator. Labor rates vary somewhat from location to location. For the most part, industry professionals note the labor rates at the Minnesota, Iowa, and Wisconsin landfills are fairly consistent from location to location. Labor rates in North Dakota are somewhat lower. Tables 5-6 and 5-7 list annual additional employment costs for the Iowa-Minnesota-Wisconsin, and the North Dakota DALFs, respectively. The additional labor cost would need to be recovered in the increased tipping fee revenue received at each facility.

Table 5-6  Additional Annual Operating Employment Costs

<table>
<thead>
<tr>
<th>Iowa, Minnesota, and Wisconsin Landfills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Equipment Operators</td>
</tr>
<tr>
<td>Mechanic</td>
</tr>
<tr>
<td>Laborer</td>
</tr>
<tr>
<td>Scale Operator</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

Table 5-7  Additional Annual Operating Employment Costs

<table>
<thead>
<tr>
<th>North Dakota Landfills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Equipment Operators</td>
</tr>
<tr>
<td>Mechanic</td>
</tr>
<tr>
<td>Laborer</td>
</tr>
<tr>
<td>Scale Operator</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

Table 5-8 is a summary of the changes in the number of employees and the costs associated for the DALFs to receive the ERL wastes. In the “No Build” Option, the 14 employees and associated $607,500 per year in ERL’s payroll will be lost. There will be three added employees at the assumed transfer station and an additional seven employees at each DALF that can handle the entire quantity of wastes diverted from the ERL. Thus,
## Table 5-8

**Employment Changes at Alternative Facilities**

**"No Build" Alternative Analysis**

**Elk River Landfill Environmental Impact Analysis**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>2650 West Cliff Rd</td>
<td>12755 137th St. E. Invet</td>
<td>2495 117th St. E.</td>
<td>175 County Rd. 37NE</td>
<td>13425 Courthouse Blvd</td>
<td>N4581 Hutchinson Rd, Eau Claire, WI</td>
<td>8001 Olson Dr., Eau Claire, WI</td>
<td>21265 430th St., Lake Mills</td>
<td>W5987 County Highway D</td>
<td>0011 190th St., Spirit Lake, IA</td>
<td>7971 32 Ave, SE, Wishek, ND 58495</td>
<td>7972 129 Ave SE, Owatonna, MN 55040</td>
<td>10700 165 Ave, NEW, Elk River, MN 55330</td>
<td>2901 Maxwell Ave, Newport, MN 55055</td>
<td></td>
</tr>
<tr>
<td>MSW Transferred (tpy)</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>0</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>90,428</td>
<td>15,000</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>IW Transferred (tpy)</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>7,106</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total Waste Transferred (tpy)</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>7,106</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>97,534</td>
<td>15,000</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Change in Facility Employees</td>
<td>-14</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Transfer Station Employees</td>
<td>NA</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Number of Drivers Required</td>
<td>NA</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>22</td>
<td>36</td>
<td>22</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total Change in Employees</td>
<td>-14</td>
<td>16</td>
<td>19</td>
<td>17</td>
<td>5</td>
<td>5</td>
<td>23</td>
<td>22</td>
<td>21</td>
<td>25</td>
<td>32</td>
<td>46</td>
<td>32</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Facility Labor Economic Change</td>
<td>-$607,500</td>
<td>$385,000</td>
<td>$385,000</td>
<td>$385,000</td>
<td>$120,000</td>
<td>$120,000</td>
<td>$385,000</td>
<td>$385,000</td>
<td>$385,000</td>
<td>$385,000</td>
<td>$25,000</td>
<td>$25,000</td>
<td>$0</td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>Transfer Driver Labor Economic Change</td>
<td>NA</td>
<td>$373,803</td>
<td>$525,004</td>
<td>$396,203</td>
<td>$18,258</td>
<td>$29,682</td>
<td>$770,005</td>
<td>$749,472</td>
<td>$657,071</td>
<td>$872,673</td>
<td>$1,314,142</td>
<td>$2,161,148</td>
<td>$1,329,542</td>
<td>$20,263</td>
<td>$59,211</td>
</tr>
<tr>
<td>Total Employment Labor Economic Change</td>
<td>-$607,500</td>
<td>$946,303</td>
<td>$1,097,504</td>
<td>$968,703</td>
<td>$325,758</td>
<td>$337,182</td>
<td>$1,342,505</td>
<td>$1,321,972</td>
<td>$1,229,571</td>
<td>$1,445,173</td>
<td>$1,886,642</td>
<td>$2,373,648</td>
<td>$1,767,042</td>
<td>$207,763</td>
<td>$246,711</td>
</tr>
</tbody>
</table>

N.A. = Not Applicable.
the net change in employment is fourteen at the ERL, three employees at the transfer station, plus seven additional employees at the receiving DALF, for a net employment change of four people less. The primary change in employment is the transfer drivers needed to haul the wastes from the transfer station to the DALFs. For DALFs that can accept all the wastes, the number of additional drivers ranges from 6 up to 36. The associated additional employment labor cost for the transfer drivers is $373,803 to $2,161,148 per year.

5.4.4 Summary of Tax Revenue Impacts

One of the key issues affecting the posted tipping fee is the level of taxes and host community fees charged by public entities. For example, at ERL, the tipping fee of $68.99 per ton includes the following taxes or fees paid to public entities:

- City of Elk River $3.33 landfill tax
- Sherburne County $0.40 host fee
- Sherburne County $0.60 landfill tax
- State of Minnesota $6.67 landfill tax

That means that there is a total of $11.00 per ton that ends up at the state, county, or city level that would no longer be available from the ERL in the “No Build” option. The estimates for these revenues are broken down as follows:

- City of Elk River - $3.33 times 356,017 tons/year equals $1,185,537 per year
- Sherburne County - $1.00 times 356,017 equals $356,017 per year
- State of Minnesota - $6.67 times 356,017 equals $2,374,633 per year

Depending on which DALF was to receive the wastes, the “No Build” option could significantly affect these revenues for the public entities. The city of Elk River would lose an estimated $1.2M per year, as none of the DALFs are within the city of Elk River. Sherburne County could lose an estimated $350,000, as there are significantly less expensive DALFs outside Sherburne County. Finally, the lowest Total Annual Cost facility is located in the State of Wisconsin; therefore, the State of Minnesota could lose approximately $2.4M if waste is transferred out of state.

5.5 Environmental Impacts at Designated Alternative Facilities

5.5.1 Landfill Gas (LFG)

To minimize environmental impacts from LFG production, the preferred control method is to collect the LFG using an active system and convert the LFG to energy using a turbine or internal combustion (IC) engine. The facilities that provide LFG conversion include:
### Table 5-9

**Site Liner and Landfill Gas Data**

**"No Build" Alternatives Analysis**

**Elk River Landfill Environmental Impact Analysis**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>2650 West Cliff Road, Burnsville, MN 55337</td>
<td>12755 137th St., Glencoe, MN 55336</td>
<td>2495 117th St. E., Inver Grove Hts., MN 55075</td>
<td>175 County Rd. 37NE, Buffalo, MN 55068</td>
<td>13425 Courthouse Blvd, Rosemount, MN 55068</td>
<td>N4581 Hutchinson Rd., Eau Claire, WI 54703</td>
<td>W5987 County Highway D, Sarona, WI 54870</td>
<td>801 Olson Dr., Spirit Lake, IA 51360</td>
<td>21265 430th St., Lake Mills, IA 50450</td>
<td>2575 190th St., SE, Wishek, ND 58495</td>
<td>7971 32 Ave. SE, Gwinner, ND 58040</td>
<td>10700 165 Ave. NW, Elk River, MN 55330</td>
<td>2901 Maxwell Ave., Newport, MN 55055</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Waste Received (tpy)</strong></td>
<td>429,682</td>
<td>364,328</td>
<td>160,544</td>
<td>303,974</td>
<td>294,906</td>
<td>274,108</td>
<td>268,441</td>
<td>460,000</td>
<td>401,000</td>
<td>321,000</td>
<td>77,000</td>
<td>16,000</td>
<td>132,000</td>
<td>432,861</td>
<td>435,012</td>
</tr>
<tr>
<td><strong>Remaining Capacity (cy)</strong></td>
<td>4,922,000</td>
<td>1,320,000</td>
<td>3,695,000</td>
<td>6,890,000</td>
<td>3,740,090</td>
<td>505,219</td>
<td>6,374,553</td>
<td>1,300,000</td>
<td>2,379,000</td>
<td>32,000,000</td>
<td>5,000,000</td>
<td>6,000,000</td>
<td>2,000,000</td>
<td>≈ 15,000 tpy</td>
<td>≈ 15,000 tpy</td>
</tr>
<tr>
<td><strong>Known Future Expansion Plans (cy)</strong></td>
<td>15,000,000</td>
<td>15,000,000</td>
<td>None</td>
<td>5,800,000</td>
<td>3,500,000</td>
<td>6,002,900</td>
<td>None</td>
<td>6,000,000</td>
<td>12,800,000</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>LFG Collection/Control</strong></td>
<td>Gas to energy IC engine</td>
<td>Gas to energy IC engine</td>
<td>Flare</td>
<td>Gas to energy Turbine</td>
<td>Flare</td>
<td>N.A.</td>
<td>Gas to energy IC engine</td>
<td>Flare</td>
<td>Flare</td>
<td>No control</td>
<td>No control</td>
<td>Passive</td>
<td>N.A.</td>
<td>N.A.</td>
<td></td>
</tr>
</tbody>
</table>

N.A. = Not Applicable.

**SOURCES:**
1 Provided by MPCA as compiled from various reports by Don Kyser, MNOEA.
Assuming the “No Build” option, the environmentally preferred alternative from a LFG perspective would be the Pine Bend Landfill due to the slightly better control efficiency of a turbine compared to an IC engine. However, the environmental preference is extremely small and is based on the published increased control efficiency of gas turbines compared to IC engines. All the facilities utilizing LFG to energy technology and flares can achieve required pollution standards as established by the MPCA and in the case of the Wisconsin landfills, the Wisconsin Department of Natural Resources. Thus, each site that actively collects and controls LFG is considered environmentally compliant should the “No Build” option be implemented. Table 5-9 contains the site and LFG data for the DALFs.

EPA publication AP-42 “Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Potential Area Sources,” Chapter 2, “Solid Waste Disposal” lists the control efficiencies for LFG control systems. Table 5-10 provides a summary of the efficiencies.

### Table 5-10 Summary of Control Efficiencies for LFG Constituents

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Constituent</th>
<th>Control Efficiency (%)</th>
<th>Typical</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler/Steam Turbine</td>
<td>*NMOC</td>
<td>98.0</td>
<td>96-99+</td>
<td></td>
</tr>
<tr>
<td>(50100423)</td>
<td>Halogenated Species</td>
<td>99.6</td>
<td>87-99+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Halogenated Species</td>
<td>99.8</td>
<td>67-99+</td>
<td></td>
</tr>
<tr>
<td>Flare</td>
<td>NMOC</td>
<td>99.2</td>
<td>90-99+</td>
<td></td>
</tr>
<tr>
<td>(50100410)</td>
<td>Halogenated Species</td>
<td>98.0</td>
<td>91-99+</td>
<td></td>
</tr>
<tr>
<td>(50300601)</td>
<td>Non-Halogenated Species</td>
<td>99.7</td>
<td>38-99+</td>
<td></td>
</tr>
<tr>
<td>Gas Turbine</td>
<td>NMOC</td>
<td>94.4</td>
<td>90-99+</td>
<td></td>
</tr>
<tr>
<td>(50100420)</td>
<td>Halogenated Species</td>
<td>99.7</td>
<td>98-99+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Halogenated Species</td>
<td>98.2</td>
<td>97-99+</td>
<td></td>
</tr>
<tr>
<td>IC Engine</td>
<td>NMOC</td>
<td>97.2</td>
<td>94-99+</td>
<td></td>
</tr>
<tr>
<td>(50100421)</td>
<td>Halogenated Species</td>
<td>93.0</td>
<td>90-99+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Halogenated Species</td>
<td>86.1</td>
<td>25-99+</td>
<td></td>
</tr>
</tbody>
</table>

*NMOC = nonmethanogenic organic compounds

LFG collection and control facilities are not required for industrial waste landfills (Onyx FCR Industrial Landfill and SKB Rosemount Industrial Waste Landfill) or Resource Recovery Facilities (Elk River and Newport). Of the remaining sites, only two landfills have no controls—the Dickinson Landfill in Iowa and the Jahner Landfill in North Dakota. Both landfill sites are under the regulatory thresholds for mandated gas collection and control. However, Waste Management Inc. does intend to install an active
LFG collection and control system at the Dickinson Landfill in the summer of 2005. The system will consist of gas collection wells, a blower, and a flare. The purpose of the system is for subsurface gas migration control.

Of the remaining facilities, one has a passive gas venting system (Dakota Landfill, North Dakota), four have active systems with flares as the control device, three have active systems that convert the LFG to energy by using IC engines, and one uses gas turbines to convert LFG to electricity and produce steam.

5.5.2 Liner Types

Each DALF in the alternatives analysis has a regulatory compliant landfill bottom liner (see Table 5-9). Some sites have enhanced liners, including:

- SKB Rosemount – this site has a double composite liner consisting of two geomembranes and a compacted clay liner. If the top geomembrane leaks, it can be detected and corrective action initiated before environmental impacts occur. However, this site can only accept industrial waste, not MSW.

- Timberline Trail, Seven Mile Creek, and Sarona landfills in Wisconsin – MSW landfills in Wisconsin are required to have bottom composite liners consisting of a geomembrane and 4 feet of clay with a hydraulic conductivity of $1 \times 10^{-7}$ cm/sec or less (NR 504.05). The additional 2 feet of low permeability clay (above the required 2 feet in Minnesota, Iowa, and North Dakota) provides for additional protection of groundwater resources at these landfills.

The remaining sites all have constructed regulatory compliant landfill liners that are compliant with state and federal standards.

Based solely on bottom liner design, it appears the three Wisconsin landfills offer more environmental protection to groundwater resources by having a geomembrane over 4 feet of clay with a hydraulic conductivity of $1 \times 10^{-7}$ cm/sec.

5.6 Summary

Table 5-11 provides a summary of the effects of not building the Landfill expansion based solely on the factors considered in this alternatives section. The effects of the "No Build" alternative are divided between direct and indirect, as well as by potential beneficial and adverse effects.

For direct effects, there are more adverse effects noted than beneficial. The lone beneficial effect noted is the potential significant increase in transfer haul employment.

Adverse direct effects include the loss of employment at ERL; need to site and permit a relatively large transfer station; a significant increase in transfer hauling cost; and simply not making full use of the potential airspace capacity at the Landfill.
For indirect effects, there are two beneficial ones noted. There will be an increase in equipment and employment at the alternative sites that will contribute to the economy. Also, based upon the analysis, the costs to users could be less (primarily avoiding the cost of local and state taxes for ERL).

Two indirect adverse effects were also noted. The airspace capacity at the alternative sites will be used up more rapidly. Also, the city of Elk River, Sherburne County, and the State of Minnesota could lose the funding provided by the taxes collected by ERL.

| Table 5-11  Summary of “No Build” Effects |
|------------|------------------------------------------|
|            | Direct                                   |
|            | Beneficial                               |
|            | • Significant increase in transfer haul   |
|            |   employment                             |
|            | • Lost employment at ERL                 |
|            | • Significant increase in transfer haul   |
|            |   costs                                  |
|            | • Need to site and permit a transfer      |
|            |   station capacity with a capital cost of  |
|            |   $5M                                     |
|            | • Less than full use of potential airspace |
|            |   capacity at the Landfill                |
|            | Indirect                                 |
|            | Beneficial                               |
|            | • Increase in equipment and labor at the  |
|            |   alternative landfills                   |
|            | • Use up airspace at other locations      |
|            | • Potential lower cost to users based on  |
|            |   apparent lower tip fees                 |
|            | • Loss of state and local funding         |
6 Environmental Impacts

6.1 Groundwater Resources

This section provides background information and evaluation of the available data for the SDA. The primary purpose of this evaluation is to analyze the potential groundwater impacts resulting from the proposed SDA.

The descriptions in sections 6.1.1 through 6.1.3 generally summarize the data collected at the facility. Sections 6.1.4 through 6.1.7 also include independent analysis and verification of information provided by ERL.

6.1.1 Summary of Groundwater Regulations

Municipal solid waste landfills are known as Subtitle D facilities and general requirements for these facilities are described under the federal Resource Conservation and Recovery Act (RCRA) 40 Code of Federal Regulations Part 258 (40 CFR Part 258). These rules establish the minimum requirements for municipal solid waste landfill performance, groundwater protection, and monitoring. States approved by EPA to administer their own solid waste programs may institute more stringent requirements. Minnesota is an approved state.

6.1.1.1 Overview of Groundwater Monitoring at Solid Waste Facilities

Modern landfills are designed to protect groundwater by preventing a release from contacting the environment outside of the landfill and by minimizing the volume of liquids (leachate) that could impair groundwater quality in the event of the release. These protective measures are essentially the same regardless of the landfill site because all facilities are required to prevent pollution to groundwater under state and federal law.

Groundwater monitoring networks and monitoring programs constitute additional design features that are specifically aimed at preventing an impact to the environment. They detect changes in water quality that can indicate a failure of the liner system before it becomes a health risk and allow for assessment of corrective actions required to prevent an impact to the environment. Unlike the engineering systems described above, groundwater monitoring utilizes site-specific features that are different for every proposed site. These features address the unique quality of the groundwater chemistry and flow conditions in order to accurately detect evidence of a release.

In order to utilize these site-specific features and assess the suitability of the site for disposal, the solid waste rules require a comprehensive study known as a hydrogeologic investigation. Even though conditions vary from site to site, the contents and scope of the hydrogeologic investigation follow a well-established set of tasks intended to demonstrate that the site is suitable for monitoring and that the monitoring network proposed will detect evidence of a release should it occur.
The majority of information regarding groundwater conditions at the SDA was derived from the hydrogeologic investigation (Geomatrix, 2004; 2005) and related reports. Additional background literature and published resources were also used to summarize the subsurface conditions as referenced in this report.

6.1.1.2 State of Minnesota Regulations

The primary rules regarding groundwater resources for landfills are found in the Minnesota Solid Waste Rules and are enforced by the MPCA. The rules are described in the following Parts:

- Part 7035.2565 – General duty to protect groundwater and avoid “pollution.”
- Part 7050.0220 – Establishes that groundwater is a Class 1 water suitable for domestic consumption.
- Part 7060.0600 to .0800 - Prohibits discharge to saturated zone (groundwater) and requires a compliance boundary for application of groundwater standards to the facility.
- Part 7035.2815 – Provides general requirements for the landfill site setting; lays out the scope of soil and groundwater investigation at solid waste facilities. These rules prescribe the requirements for a phased investigation of subsurface conditions to demonstrate that the proposed site is suitable for landfilling, and to establish an appropriate monitoring network. The investigations and studies conducted by Waste Management meet or exceed these requirements.

Additionally, the Minnesota Department of Health (MDH) is authorized under Minnesota Stat. §§144.381 to 144.387 to enforce standards for public water supplies, well construction and maintenance. The following rules apply under MDH jurisdiction:

- Part 4725 – Includes requirements for construction and permitting of wells and borings (including monitoring wells).
- Parts 4717.7100 to 4717.7800 – Provides standards for groundwater quality known as Health Risk Limits (HRLs).
- Part 4740 – Sets out the requirements for certification of laboratories that conduct the analysis of groundwater samples.

The tasks related to groundwater and subsurface investigations are performed under the direction of licensed professional engineers and/or geologists. The requirements and enforcement of licensure for these professions is described in Minn. R. chs. 1800 and 1805 administered by the Minnesota Board of Architecture, Engineering Land Surveying, Landscape Architecture, Geoscience, and Interior Design.
6.1.1.3 Other Rules

Sherburne County has a solid waste ordinance that adopts the requirements of the Minnesota Rules and allows for inspection and collection of monitoring networks and groundwater samples. The City of Elk River also requires a solid waste license; however there are no specific or additional groundwater requirements in the City license.

6.1.2 Review of Groundwater Quality Standards

The applicable water quality standards for landfills in Minnesota are typically based on the HRLs described above. In some cases, Health Based Values (HBVs) as determined by the MDH, federal Maximum Contaminant Levels (MCLs), may be used for specific constituents. Surface water standards may be appropriate if the discharge of groundwater is to a surface water body at or near the property boundary. As discussed later in this chapter, it does not appear that groundwater from under the SDA will discharge to any nearby surface water body, including Rice Lake/Tibbits Brook. Therefore, a discussion of surface water standards is not required for the SDA.

In accordance with the Minn. R. 7035.2815 subp. 4 (E, F, and H), an intervention limit (IL) is established for each parameter included in the detection monitoring list. The IL is lower than the HRL for each constituent on the list and is typically \( \frac{1}{4} \) the HRL (or other applicable standard) concentration. This lower threshold is intended to provide ‘early warning’ so that there is sufficient time to institute corrective action before a potential release moves off site at levels that might be a possible risk to groundwater users.

In some cases, background concentrations may be determined to be elevated above the IL or even the HRL due to naturally occurring groundwater conditions. In these cases, an alternative IL is established. The alternative can be a background concentration calculated from either the upgradient wells or from the historical data collected in a downgradient well. Most often these background data are collected prior to waste placement and are updated during subsequent monitoring events.

The parameters for routine detection groundwater monitoring at MSW facilities include major ion chemistry, general parameters such as pH, temperature, and specific conductance; volatile organic compounds (VOCs), and dissolved metals. Samples from the wells are collected for routine detection monitoring during the operational life of the facility and during its post-closure care period. The sample results from each well are compared to the ILs during each event.

If an exceedence above the ILs is detected, it is confirmed by resampling. If confirmed, the additional analysis and monitoring is conducted to evaluate the potential for a release to groundwater. Additional investigation may be done to define the extent of the release and then corrective actions are instituted to ensure that the release does not affect groundwater users.
6.1.3 Description and Evaluation of Soils and Geologic Conditions

The following sections describe the specific information required by Minn. R. 7035.2815. The information provided by ERL appears to be complete and meets or exceeds the technical requirements of the rules.

6.1.3.1 Physiography

The regional setting for the SDA is within the Anoka Sand Plain that includes large portions of Anoka, Chisago, Isanti and Sherburne Counties. Regionally, the surficial geology of the area is characterized by approximately a 100 to 200-foot thick sequence of unconsolidated glacial and glaciofluvial deposits (sand and gravel with silt and till). Hobbs and Goebel (1982) indicate that these materials are associated with north-south trending eskers that extend from north of the proposed project site southward through the Elk River Gravel Mining District. The surface expression within this area consists of linear trending ridges, generally hilly topography separated by broad low areas often occupied by lakes and wetlands.

The SDA property is located south of the existing landfill and is bounded to the east by Highway 169, to the south by 221st Street, and to the west by a former railroad track that is currently utilized as walking/biking path. The ground surface elevation at the site varies from approximately 970 feet mean sea level (MSL) on the western side to approximately 1,045 MSL in the central and northeastern portions of the site. Roughly the eastern two-thirds of the site have been developed to accommodate the asphalt mixing, aggregate mining, and stockpiling operations. The ground surface elevation at the asphalt plant and aggregate stockpile area is approximately 1,015 feet MSL.

Three discontinuous ridges are the primary topographic features within the SDA. South of the SDA and north of the existing facility, several elongated ridges interpreted by others to be eskers have been identified (Lusardi, 2002 and 2003). Soils within the discontinuous ridges at the SDA (above the elevation of 960 feet MSL) will be removed by future aggregate mining operations. The eastern two-thirds of the SDA have been disturbed by mining and is sparsely to non-vegetated.

6.1.3.2 Soils

The Soil Survey of Sherburne County describes surficial soils at the site as being comprised predominantly of the Stonelake–Sanburn and Stonelake–Nebish complexes. The Stonelake series is profiled generally as a very deep (more than 60-inches), excessively drained, glacial outwash with slopes ranging from 1 to 40 percent. The glacial outwash consists mainly of a gravelly loam to coarse sand. These soils are reported in the soil survey to have a rapid to very rapid infiltration rate. These soil types are characteristic of a relatively large area including the project site and extending to the south, and which comprises the Elk River Sand and Gravel Mining District.
As previously described, the granular soils associated with the site will or have been largely been removed prior to the proposed SDA project. Therefore the properties of the native soil (e.g. their ability to attenuate a potential release from the facility) are not relevant to this assessment of potential for groundwater impact.

6.1.3.3 Geologic Setting – Quaternary Deposits
The advance and re-advance of glaciers during the last ice age left behind a complex sequence of generally fine-grained, low permeability materials inter-layered with sandy, more permeable outwash layers. The general sequence in the vicinity of the proposed development includes unconsolidated soils that can range in thickness from less than 100 to more than 200 feet over bedrock comprised of Cambrian sandstone. Each of the main geologic units is described below:

Upper Glacial Till Complex
The upper glacial till complex is generally unsaturated and consists of mixed sand and gravel within a fine-grained matrix. It consists of two separate till subunits that are generally located above the water table over most of the SDA.

The upper subunit is shown on the surficial geology map (Figure 3) and is a thin discontinuous clay-matrix till attributed to the Grantsburg Sublobe of the Des Moines Lobe ice sheet. This material was deposited during the last advance of the Late Wisconsin and likely is associated with outwash and eolian (wind-blown) sediments (Lusardi 2001).

The lower subunit of the upper till is an older silty-sand matrix till deposited by the Superior Lobe ice sheet. Both units have intervening layers of sand, silty, sand and clay layers. The lower subunit is similar lithologically to the lower till complex described below.

Together these subunits form a single, generally low permeability unit that acts as barrier to infiltration (where present) under the proposed facility. The upper till complex unit is found at or above the water table on the western and southeastern portions of the site. This unit does not transmit significant quantities of water but it does play a role in groundwater flow. It forms a barrier to groundwater flow and therefore flow paths are deflected around the till where present at the water table.

Upper Outwash Unit
Under and around the upper till is the upper (water table) outwash unit. This material is generally sandy with some gravel. This unit was likely deposited by meltwater during a retreat and/or re-advance of the Superior Lobe ice front. The base of the landfill will be constructed above the water table and within this unit over the majority of the SDA.

This unit forms the uppermost saturated unit under the proposed facility. Therefore, the Upper Outwash is the primary monitoring zone because any potential release would travel within this unit.
**Lower (Superior Lobe) Till Complex**

Below the outwash is a complex of upper till-derived, ice-contact and lacustrine subunits underlain by basal till subunit that is associated with an earlier advance of the Superior Lobe glaciations. Together these fine-grained deposits form a low permeability unit that extends across the entire SDA.

The complex is comprised of greater than 50% clay and/or silt and exhibits a firm- to very hard, cohesive matrix. The lowermost portion of the deposits is a basal till that is extremely dense (over consolidated) and has low permeability. The increased density of this unit is likely the result of being overridden by the re-advance of the Superior Lobe ice sheet as well as the later burial by the Des Moines Lobe and associated deposits.

Basal till is deposited as the ice sheet advances and is typically laterally continuous. This till is an important confining layer at the site because it separates the upper and lower outwash water bearing zones.

**Lower Outwash Unit**

The outwash sand and gravel that underlies the till is similar texturally to the upper outwash. Groundwater flow in this unit is likely controlled mainly by recharge from upgradient areas located north and east of the SDA. This unit was likely deposited from meltwater in front of the advancing Superior Lobe ice sheet.

**6.1.3.4 Geologic Setting – Cambrian Bedrock**

The uppermost bedrock unit in the area is the Eau Claire Formation, a regional confining unit which consists of red and grayish-green, fine-grained silty sandstone, siltstone, and shale (Kanivetsky and Walton, 1979). A relatively thin mantle of the Galesville Sandstone (basal portion) has been encountered above the Eau Claire Formation north of the SDA (Geomatrix, 2003b). Depth to bedrock varies from 135 feet to more than 200 feet. This unit is apparently not utilized for use as a water supply due to its relatively low yield (Geomatrix 2004).

The uppermost bedrock unit utilized for water supply is the Mount Simon/Hinckley Formation which consists of fine- to coarse-grained sandstone. The Mount-Simon/Hinckley aquifer underlies the Eau Claire Formation and is estimated to be approximately 300 feet thick in the area (Wolf, et al., 1983). This unit is routinely monitored for groundwater quality in private wells located downgradient of the facility (Geomatrix 2005).
6.1.4 Description and Evaluation of Hydrogeologic Conditions

6.1.4.1 General Hydrogeologic Setting

Regional groundwater flow in the outwash deposits and bedrock aquifer is to the west-southwest. Regional groundwater flow direction near the site in both the unconsolidated and deeper bedrock formations is reportedly to the west and south with discharge to the Elk and Mississippi Rivers (“Regional Hydrogeologic Assessment Anoka Sand Plain,”1993).

Data from the existing facility indicates that groundwater in the Mount Simon/Hinckley aquifer is not hydraulically connected to the overlying glacial deposits. Within the glacial deposits, regional groundwater flow is limited to outwash deposits with the less permeable till deposits acting as aquitards.

Recharge to groundwater at the site is primarily from infiltration of precipitation, and to a lesser extent, surface water. Most of this infiltration is from upland areas located generally east of the SDA. Some infiltration is derived from the soil materials at the SDA including mined areas, and a small wetland in the southwest corner of the site that has developed on clay deposits near the water table. The development of the SDA will likely redirect most of this infiltration to stormwater basins located near the southwest and southeastern edge of the SDA.

6.1.4.2 Principal Hydrostratigraphic Units

As shown on the hydrostratigraphic section (Figure 4) and on the geologic cross section (Figure 5) the principal hydrostratigraphic units correspond to the geologic units described above. The location of the section C-C’ in Figure 5 is shown on Figure 6.

6.1.4.3 Analysis of Groundwater Occurrence and Flow

The depth to groundwater varies from 5 to more than 50 feet below the ground surface and the uppermost saturated zone (water table) is located in the upper outwash except where it intersects discontinuous portions of the overlying upper glacial till unit.

Upper Outwash

The water table elevation is at approximately 955 feet MSL on the upgradient (northeast) side of the SDA and at about 953 feet MSL on the southwest. Groundwater flow is generally from northeast to the southwest as shown on Figure 6. Vertical hydraulic conductivities are on the order of 0.001 feet of head loss per linear foot. The units of ‘feet per foot’ are included above for clarity, but gradient measurements are typically expressed without units.

Horizontal hydraulic conductivity was tested at wells screened at four separate locations in the outwash. The geometric mean value of these measurements is \(7 \times 10^{-2}\) centimeters per second (cm/sec) or 198 feet per day (ft/d). Although within range of literature values for this material, the hydraulic conductivity of this unit is quite high. As described
below, the vertical hydraulic conductivity in the till unit is $1 \times 10^{-8}$ cm/sec. The much higher hydraulic conductivity in the outwash indicates that flow is predominantly horizontal.

Using the permeability value of 198 feet per year (ft/yr), the gradient of 0.001, the average linear velocity is about 226 ft/yr assuming an effective porosity of 0.32. The corresponding estimates for specific discharge are 21 to 72 ft/yr and average 47 ft/yr.

**Lower (Superior Lobe) Till Complex**
The lower till unit is a confining unit at the SDA. It has a geometric mean hydraulic conductivity of $1 \times 10^{-8}$ cm/sec or $2.8 \times 10^{-5}$ ft/d based on six measurements. Vertical gradients measured between the upper and lower outwash units are on the order of 0.07 based on readings at well nest 317-OWA and P-317L. At 40% effective porosity, the specific discharge is approximately 0.0012 ft/yr. This means that the volumetric flux (again using Darcy’s law) would be on the order of $2.8 \times 10^{-5}$ ft/d x 0.06 x 3.7M sf x 7.48/24 x 60) = 0.04 gpm.

At 40% effective porosity, the advective travel time required for a contaminant to penetrate the till is about 550 years per foot of till thickness. The minimum till thickness observed in borings at the facility is 5 feet. The total travel time at this location would be 2,750 years. Based on these calculations, this confining unit would prevent migration of contaminants to the lower outwash unit.

**Lower Outwash**
The lower outwash unit is at a depth of approximately 80 feet below the ground surface or elevation 900 feet MSL. Groundwater flow occurs under confined conditions and the flow direction is from northeast to southwest (Figure 7). The horizontal gradient is on the order of 0.002. Hydraulic conductivity in this unit is on the order of $2 \times 10^{-3}$ cm/sec or about 6 ft/d. Effective porosity is estimated at 0.32 so that the advective velocity is 13 ft/yr with a corresponding specific discharge of 4 ft/yr.

The confined hydraulic conditions and difference in hydraulic conductivity between the overlying till and the outwash indicates that flow is predominantly horizontal in the lower outwash unit.

**6.1.4.4 Groundwater Divides (No-Flow Boundary Conditions) at the SDA**
A groundwater divide acts as a boundary to groundwater flow similar to the way a drainage divide acts as a boundary to surface water flow. As shown on Figure 8, a groundwater divide exists at the northern edge of the SDA. The presence of the divide is a function of both flow dynamics and a relatively thick ridge of low-permeability till that exists in this area.
The following observations and conclusions regarding the groundwater divide along the boundary with the existing landfill and the SDA were made:

- A review of water level data from the March 4, 2004 monitoring event indicates that the groundwater divide has moved to the north of the SDA during this generally low water level event. Virtually none of the flow from under the SDA would move to the northwest during similar flow conditions and would result in no discharge to the Rice Lake/Tibbits Brook wetland complex during these periods.
- Review of cross sections (such as Figure 5 and Figure 8; section location 1) indicates that the divide is primarily controlled by the topographic expression of the underlying till unit in that the saturated thickness decreases over the till in the northern portion of the SDA. Therefore, the divide is somewhat independent of hydrodynamic stress on the aquifer, particularly due to drought or pumping.

6.1.5  Description of Proposed Groundwater Monitoring Program

6.1.5.1  Principal Monitoring Zone and Monitoring Well Network

The primary monitored unit for the SDA is the upper outwash saturated unit corresponding to the water table. A hypothetical release from the facility would travel mainly within this unit. The proposed monitoring network for the SDA is shown on Figure 6, and for the entire facility on Figure 9. It consists of eight wells in the SDA (2 upgradient and six downgradient) as well as two wells located in the southwest corner of the existing landfill that monitor groundwater flowing toward the Rice Lake Wetland/Tibbits Brook complex. Additional temporary wells are also currently monitored within the facility footprint but will be sealed prior to construction of the portion of the SDA where they are located. The proposed compliance boundary for the SDA is within 200 feet of the proposed facility’s waste boundary as allowed by Minn. R. 7035.2815 subp 4 (c) 2. Each of the wells is positioned within the compliance boundary along or near the principal flow paths for groundwater. A release from the facility would likely travel along these flow paths and be intercepted by the screened interval of one or more of these wells.

As described below there is very little potential for discharge either directly or indirectly to reach any nearby streams or lakes from the SDA. Therefore, compliance with groundwater quality standards will be determined through ground water monitoring.

6.1.5.2  Other Monitoring Zones

The lower outwash unit will be also be monitored for water levels only. This unit is separated from the upper outwash by the lower till complex (confining unit) and is not likely to be impacted by the facility. Therefore, water quality sampling within this unit is not justified or necessary.
6.1.6 Analysis of Potential Groundwater Impact

Modern landfills are designed specifically to protect groundwater from a release, and the environmental monitoring system is intended to detect a release before it can pose a risk to the environment.

Therefore, the analysis of a potential release is described here as “hypothetical” because for the release to occur would likely require a worst-case scenario involving multiple construction, operational, and monitoring failures.

6.1.6.1 Hypothetical Release Scenario

Source for a release at a landfill is leachate that is derived from liquids in contact with the waste. The leachate would migrate downward through the liner system, through the unsaturated zone, and reach the water table below the release point under the landfill. The leachate would then mix with the groundwater and move along the flow paths within the upper outwash units toward the SDA boundary. With the exception of the extreme northern and southwestern edges of the SDA, the hypothetical release would migrate to the southwest.

Once the release reaches the downgradient edge of the SDA, elevated concentrations of leachate constituents would begin to appear in the samples collected from downgradient wells located near the boundary of the facility.

6.1.6.2 Contaminant Fate and Transport

A release of leachate in groundwater would be subject to several physical and chemical processes that tend to reduce the concentrations of the leachate constituents in groundwater before they reach the edge of the facility.

The primary physical process related to attenuation of the contaminants is dispersion. Dispersion results from the mixing of groundwater under the facility and results in spreading of the leachate laterally and vertically as it moves through the pore spaces of the upper outwash unit. Dispersion would be increased if the leachate were located in an area where the facility is underlain by fine-grained glacial till or ice-contact deposits. The spreading of the contaminants also makes it likely that any constituents that migrate to the boundary will be detected in samples from one or more monitoring wells.

The chemical and biochemical processes related to the leachate are specific to particular constituents within the leachate. For example, many volatile organic compounds are often adsorbed by organic carbon, volatize, or are consumed by microbial processes. Metals such as arsenic often are adsorbed within the soil matrix, particularly within clay or precipitate from solution into a solid form that is not as easily transported in groundwater.
6.1.6.3 Potential Impact to Rice Lake/Tibbits Brook Wetland Complex

Groundwater flow is toward the southwest and therefore, there is very little potential for groundwater from the SDA to discharge to the Rice Lake/Tibbits Brook wetland complex. There is a small wetland located west of the SDA, but the elevation and location of this wetland suggests that it is neither a significant discharge area for groundwater from the SDA nor is it connected with the much larger Rice Lake Wetland complex to the north.

The groundwater divide on the northern edge of the SDA acts as a no-flow boundary as described above. It is likely that reduction in future infiltration as the SDA is developed will increase gradients and may shift this divide further to the north. This means the potential for an impact to the Rice Lake/Tibbits Brook wetland complex from the SDA will be lower in the future.

Currently, a small portion of flow from under the SDA may move toward the Rice Lake/Tibbits Brook wetland complex on a seasonal basis. As shown on Figure 6 these flow paths intersect the monitoring network located on the southwestern portion of the existing landfill. Therefore, a release from the northern portion of the SDA would likely be detected in these wells before entering the wetland complex. The magnitude of a potential release would depend on the location of the release, strength of and quantity of the leachate released, the proportion of the release (if any) moving along the flow path toward the Rice Lake/Tibbits Brook wetland complex and the subsequent dilution, dispersion, and attenuation of the plume prior to reaching the wetland complex.

Because the leachate sumps are the locations within the SDA that are most likely to result in measurable quantity of leachate in the event of a hypothetical release, the design and location of these sumps is often incorporated into the design of the monitoring network. Modifying the design of the landfill to include placement of the leachate sumps south of the no-flow boundary could add an added factor of safety to prevent impacts to the Rice Lake/Tibbits Brook wetland complex.

6.1.6.4 Other Potential Receptors

Groundwater from deep glacial and bedrock units is the primary water supply to residences and industry in the vicinity of the proposed development. Groundwater flowing in the uppermost saturated unit (typically the outwash) is generally not used for private water supply purposes. The majority of wells are screened in relatively deeper outwash aquifer that is separated from the landfill by a confining unit(s) that would prevent migration of contaminants to these wells.

An inventory of well records in Geomatrix (2005) indicates that there are 3 active water supply wells immediately downgradient of the SDA as shown in Figure 10 (wells 65, 187 and 190). Two of these wells, (#65 and #187) are routinely sampled as part of the existing landfill monitoring program. The potential impact to each well is described below.
The nearest of these wells (#65) is approximately 500 feet southwest of the SDA boundary. Because this well is screened in a lower outwash unit approximately 55 feet below the water table, and is separated from the upper outwash unit by a clay confining unit, it is unlikely to be affected by a hypothetical release at the SDA.

Well 187 is screened approximately 80 feet below the water table and is separated from the water table outwash unit by a confining layer. Similarly, well 190 is screened 70 feet below the water table and is also separated from the water table outwash by several clay confining units.

There are also two higher capacity wells farther downgradient from the facility that are apparently screened in deeper bedrock units that are separated hydraulically from the facility by one or more confining units. These wells are also unlikely to be affected by the SDA.

There are other wells in the vicinity of the landfill but they do not appear to be potential receptors of groundwater moving under the SDA because they are relatively distant from the facility and are located hydraulically upgradient or sidegradient to the SDA. These factors make it unlikely that pumping from these wells could impact the SDA.

6.1.7 Conclusions of Groundwater Impact Analysis

The following conclusions are apparent based on the evaluation of the groundwater data for the SDA:

- The SDA has been adequately characterized and meets the requirements of applicable groundwater regulations.
- The hydrogeologic conditions at the site are suitable for development of the facility. Groundwater moves within a saturated unit (upper outwash) that is both well-defined and can be monitored to detect a release.
- The monitoring program will include lysimeter testing that provides early warning of a release. The groundwater monitoring well network is designed to detect a release and includes numerous downgradient wells that are well positioned to provide warning of a release.
- The potential impact to downgradient receptors is low and monitoring of the nearest downgradient supply wells is part of the existing landfill sampling program.
- The potential for impact to the Rice Lake/Tibbits Brook wetland complex is very low. Only a small portion of groundwater from the SDA can move to discharge at the wetland complex and the quality of this groundwater would be intercepted by one or more monitoring wells prior to reaching the wetland.

Based on the foregoing conclusions, it does not appear that there is likely to be a potential impact to groundwater or surface water from leachate generated at the proposed facility.
6.2 Stormwater Management

This section discusses the stormwater management plan proposed for the SDA and the potential impacts of stormwater to the Rice Lake/Tibbits Brook wetland complex, and the wetland located in the southwest corner of the SDA site. This section will include a discussion of the potential changes in quantity of sediment loading from stormwater routed to different watersheds as a result of the SDA project.

6.2.1 Background

The Rice Lake wetland complex is located north and west of the proposed SDA (Figure 2). Tibbits Brook flows through Rice Lake. The Rice Lake wetland complex and Tibbits Brook are physically separated from the site by the abandoned railroad bed that forms the western boundary of the existing Landfill and the proposed SDA. The Rice Lake/Tibbits Brook wetland complex is designated as a Protected Water 71-15P on the Minnesota Department of Natural Resources (DNR) Protected Waters Inventory, and is designated as a Natural Environment Lake in both the Sherburne County and City Shoreline Ordinances.

The National Wetland Inventory map indicates that there is one unnamed wetland, 0.5 to 1-acre in size, located in the southwest corner of the SDA site adjacent to the abandoned railroad bed. One of the three sedimentation basins, used for storage of stormwater runoff will discharge to this wetland (Figure 15).

The proposed SDA is located on a watershed divide resulting in drainage to three different watersheds; Trott Brook, Tibbits Brook, and an unnamed watershed located in the southern portion of the site (Figure 16).

The SDA will be developed in phases, progressing from north to south (Figure 11). Gravel mining operations will be conducted concurrently with landfill development, also progressing from north to south, working ahead of landfill development. Stormwater controls for the SDA will be constructed in phases, including temporary, interim controls and final, ultimate controls. Interim controls include temporary drop pipes to convey stormwater from the closed landfill cells to temporary infiltration ponds in the mining area. Ultimate controls include gabion-lined down-slope channels, perimeter piping and ditches, and permanent sedimentation ponds.

6.2.2 Applicable Regulations

Development of the SDA would require construction activities near the wetland in the southwest corner of the SDA site and the routing of treated stormwater runoff through this wetland. Applicable regulations for the potential impact of construction activities and stormwater on surface waters are described below.
6.2.2.1  RCRA Subtitle D
The RCRA municipal solid waste program (Subtitle D) regulates owners and operators of municipal solid waste landfills. The regulations stipulate minimum criteria that each landfill must meet in order to continue operating.

6.2.2.2  MPCA Solid Waste Rules
MPCA Solid Waste Rule 7035.2815, subp. 5 specify requirements for drainage control, including runon and runoff control, collection and diversion systems, erosion control, and sediment control.


The MPCA Landfill Slope Guidance Document specifies special requirements for stormwater controls for final landfill slopes that are steeper than 20%.

6.2.2.3  Minnesota General Stormwater Permit for Construction Activity
A Minnesota General Stormwater Permit for Construction Activity is required for the SDA. A Global Information System (GIS) special waters search was conducted to determine if an individual National Pollutant Discharge Elimination System (NPDES) construction stormwater permit would be required for the SDA. The search results verified that an individual permit will not be required.

The Minnesota general stormwater permit includes but is not limited to the following requirements:

- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP)
- Construction of temporary sediment basins
- Construction of permanent stormwater management system
- Implementation of best management practices (BMPs)
- Inspections and maintenance of BMPs

6.2.2.4  Minnesota General Stormwater Permit for Industrial Activity
A Minnesota General Permit for Authorization to Discharge Stormwater Associated with Industrial Activity is required for the SDA.

The Minnesota general permit includes but is not limited to the following requirements:

- Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP)
- Identification and inventory of exposed significant materials
- Evaluation of facility areas for exposed significant materials
• Description of appropriate best management practices (BMPs)
• Evaluation of all discharge conveyances from the site
• Development of a preventative maintenance program
• Development of a spill prevention and response procedure
• Development and implementation of an employee training program
• Identification of personnel responsible for managing and implementing the SWPPP

6.2.2.5 U.S. Army Corps of Engineers Section 404 Permit

An U.S. Army Corps of Engineers (ACOE) Section 404 Permit is required for the discharge of dredged or fill material into waters of the United States; which include wetlands. Regulated discharges include filling wetlands for development, grading, or pushing material around within a wetland, disturbing wetland soil during land clearing, and other activities that would adversely impact the wetland.

The ACOE guidelines require that the activity be the least environmentally damaging alternative that is feasible, and that the adverse impacts are avoided, then minimized, and then compensated for (such as creating or restoring wetlands to replace those that would be filled.) Completely avoiding water and wetland areas will eliminate the need for a Section 404 permit. A Section 404 permit should not be required and will be verified during the permitting process.

6.2.2.6 Wetland Conservation Act

The Minnesota Wetland Conservation Act (WCA) regulates impacts to wetlands, including stormwater impacts. The Minnesota Legislature approved the WCA in 1991 in response to public concern about Minnesota’s disappearing wetlands. The Minnesota Board of Water and Soil Resources administers the act state-wide, and the DNR enforces it. Local government units – cities, counties, watershed management organizations, soil and water conservation districts, and townships – implement the act. The city of Elk River would be the local governmental unit responsible for implementation of WCA for any wetland impacts associated with the development of the SDA.

The WCA requires that the wetland mitigative sequence be followed in accordance with Items 1 or 2 below:

1. If the potential adverse impacts to a wetland on a specific project site have been addressed by permits or other approvals from an official statewide program (U.S. Army Corps of Engineers 404 program, Minnesota Department of Natural Resources, or the State of Minnesota Wetland Conservation Act) that are issued specifically for the project and project site, the Permittee may use the permit or other determination issued by these agencies to show that the potential adverse impacts have been addressed. Deminimus actions can be used as determinations by the permitting agency to address the project impacts, whereas a non-jurisdictional determination can not be used to address project impacts.
2. If there are impacts from the project that are not addressed in one of the permits or other determinations discussed in Item 1 above (e.g., permanent inundation or flooding of the wetland, significant degradation of water quality, excavation, filling, draining), the Permittee must minimize all adverse impacts to wetlands by utilizing appropriate measures. Measures used must be based on the nature of the wetland, its vegetative community types and the established hydrology. These measures include, in order of preference:

   a. Avoid all significant adverse impacts to wetlands from the project and post-project discharge.
   b. Minimize any unavoidable impacts from the project and post project discharge.
   c. Provide compensatory mitigation when the Permittee determines that there is no reasonable and practicable alternative to having a significant adverse impact on a wetland. For compensatory mitigation, wetland restoration or creation shall be of the same type, size and whenever reasonable and practicable in the same watershed as the impacted wetland.

Certain wetland activities are exempt from the act, allowing projects with minimal impact or projects located on land where certain pre-established land uses are present to proceed without regulation.

6.2.2.7 Water Quality Standards for Potential Receiving Waters

The stormwater controls for the SDA should be designed and constructed in a manner that is protective of the water quality standards and beneficial uses of the potential receiving waters. Water quality standards and related provisions are found in several Minnesota rules, but the primary rule for state-wide water quality standards is Minn. R. Part 7050. Minn. R. Part 7050 includes provisions for the protection of wetlands.

“Beneficial uses” are the uses that states decide to make of their water resources. The process of determining beneficial uses is spelled out in the federal rules implementing the Clean Water Act. Seven beneficial uses are defined in Minn. R. 7050.0200. These uses and the use-class designations are listed below. The class numbers 1–7 are not intended to imply a priority ranking to the uses.

- Drinking water – Class 1
- Aquatic life and recreation – Class 2
- Industrial use and cooling – Class 3
- Agricultural use, irrigation – Class 4A
- Agricultural use, livestock and wildlife watering – Class 4B
- Aesthetics and navigation – Class 5
- Other uses – Class 6
- Limited Resource Value Waters – Class 7.
All surface waters, lakes, rivers, streams and wetlands in Minnesota are either Class 2, protected for aquatic life and recreation, or Class 7, designated as Limited Resource Value Waters. In addition, all surface waters (i.e., both Class 2s and 7s) are protected for industrial use (Class 3), agricultural uses (Class 4A and 4B), aesthetics and navigation (Class 5), and other uses (Class 6). Therefore, all surface waters are protected for multiple uses.

Based on information provided by the MPCA’s Water Quality Standards team, the small wetland located in the southwest corner of the SDA is unlisted and classified as a 2D, 3D, 4C, 5 and 6 water. This wetland is not listed as a total maximum daily load (TMDL) impaired water body.

The Rice Lake/Tibbits Brook wetland complex is classified as both a wetland and a lake. The Rice Lake/Tibbits Brook wetland complex is an unlisted water body and is not listed as TMDL impaired water body. The wetland portion of this complex is classified as a 2D, 3D, 4C, 5, and 6 water. The lake portion of the wetland complex is classified as a 2B, 3B, 4A, 4B, 5, and 6 water.

Another facet of water quality standards is nondegradation. The fundamental concept of nondegradation is that lakes, rivers and other waters of the state whose water quality is better than the applicable water quality standards should be maintained at that existing high quality, and not allowed to degrade to a level of applicable standards.

Under Minn. R. 7050.0186, Minnesota has a specific policy to protect wetlands from significant adverse impact on wetland designated uses. Any action being permitted by a NPDES/SDS permit and resulting in a physical alternation to a wetland must comply with the mitigation sequence in Minn. R. 7050.0186. Wetland mitigation maintains nondegradation of wetland designated uses. The mitigation sequence in Minn. R. 7050.0186 follows the same principles as that found in the WCA and the ACOE Section 404 guidelines; adverse impacts are avoided, then minimized, and then mitigated by compensation if impacts are unavoidable.

6.2.3 Stormwater Management and Analysis

This section presents an analysis of the changes in quantity, quality and velocity of stormwater runoff generated as a result of the SDA during various phases of development.

The HydroCAD stormwater modeling program using the Soil Conservation Service (SCS) Curve Number method was used to calculate runoff hydrographs for the proposed landfill expansion. The SDA was divided into sub-watersheds that define the contributing drainage areas of the landfill. Peak flows from the sub-watersheds were calculated for a 25-year, 24-hour storm event of 4.7 inches and 100-year, 24-hour storm event of 5.9 inches. Runoff curve numbers of 77, 80, 100 were used for the landfill top, sides and ponded water in the sedimentation basins, respectively. Times of concentration were computed using hydraulic distance and flow velocity according to Natural
Resources Conservation Service (NRCS, formerly the SCS) Hydrology Guide to Minnesota and input directly into the HydroCAD model. The HydroCAD runoff calculations presented in this chapter are based on the design criteria and inputs specified above.

6.2.3.1 Existing Conditions

The proposed landfill expansion area is currently being mined for aggregate. The progression of mining is from north to south within the SDA footprint. The mining activities result in large depressions that have the capacity to provide substantial storage and infiltration for onsite stormwater management. As shown in Figure 12, the majority of the stormwater runoff currently generated within the SDA footprint, flows north to a storage basin associated with the existing Landfill. Only stormwater generated in the southwest portion of the site (watersheds 11, 12, 14 and 15) flows into the southwest wetland as shown in Figure 12.

Information provided by ERL indicates the stormwater runoff volume generated onsite during existing conditions for a 25-year 24-hour event and 100-year, 24-hour event is 14.6 acre-feet (ac-ft) and 23.1 ac-ft, respectively. The flow rate at which stormwater runoff is entering the southwest wetland resulting from the 25-year and 100-year, 24-hour storm events is 10.43 cubic feet per second (cfs) and 22.83 cfs, respectively.

6.2.3.2 Initial Construction of SDA

The initial construction condition of the SDA occurs during the filling of Cell 17 and construction of Cell 18 (Figure 13).

Stormwater generated during initial construction will be piped to an interim pond located south of the active cells. However, after final cover is placed on cell 17, stormwater runoff generated on the final cover slopes of Cell 17 will flow north to a sedimentation basin associated with the existing Landfill. Stormwater generated from construction and operation of Cell 18 will be managed as described below for Interim Conditions.

6.2.3.3 Interim Conditions (Ongoing Operations and Development)

The interim condition phase includes development after Cell 18 is constructed until final closure is complete. The stormwater management plan for interim conditions includes a combination of ultimate and temporary controls. The stormwater runoff from the cells that have received final cover will be directed off the cover by constructed swales. These swales will either direct stormwater runoff to permanent down-slope structures or temporary drop pipes that will be constructed at various intervals of cell development. The temporary pipes will be used when the limits of final cover construction do not extend to the location of the permanent down-slope structures.

The temporary drop pipes were sized using Minnesota Department of Transportation (MnDOT) Drainage Inlet Control Nomographs to handle maximum peak flows and/or
flows generated during a 100-year, 24-hour storm event. A summary of interim piping design data and results is presented in Table 6-1.

### Table 6-1 Interim Piping Requirements

<table>
<thead>
<tr>
<th>Landfill Location</th>
<th>Drainage Area (ac)</th>
<th>Flow (cfs)</th>
<th>Stormwater Volume (ac-ft)</th>
<th>Piping Requirements (Quantity – *CPEP size)</th>
<th>Pipe Capacity (100-year Flow, Peak Flow) (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Terrace – East</td>
<td>10.2</td>
<td>49.2</td>
<td>2.9</td>
<td>1-30”, 1-24”</td>
<td>48-58</td>
</tr>
<tr>
<td>Upper Terrace – West</td>
<td>13.5</td>
<td>59.0</td>
<td>3.8</td>
<td>2-30”</td>
<td>56-70</td>
</tr>
<tr>
<td>Lower Terrace – East</td>
<td>2.9</td>
<td>17.0</td>
<td>0.9</td>
<td>1-24”</td>
<td>20-23</td>
</tr>
<tr>
<td>Lower Terrace – West</td>
<td>4.1</td>
<td>23.8</td>
<td>1.3</td>
<td>1-30”</td>
<td>28-35</td>
</tr>
<tr>
<td>East Perimeter Ditch</td>
<td>-</td>
<td>66.2</td>
<td>-</td>
<td>2-30”</td>
<td>56-70</td>
</tr>
<tr>
<td>West Perimeter Ditch</td>
<td>-</td>
<td>82.8</td>
<td>-</td>
<td>2-36”</td>
<td>90 (peak)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>30.7</strong></td>
<td><strong>8.9</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*CREP = Corrugated Polyethylene Pipe

The temporary drop pipes will be cut into the intermediate cover or placed on top of the existing grade and then covered with two feet of cover. Settling areas will be formed into the intermediate cover and ditch bottom at the pipe inlets in order to capture the flow from the drainage terraces and perimeter ditches. Screw anchors will be installed at the upstream and downstream ends of each section of pipe to prevent the pipe from sliding down the slope. A one-foot safety bench will be constructed around the piping inlet. Based on calculations provided by ERL, the drainage terrace Froude Number is 0.88. A Froude Number less than 1 indicates subcritical flow. Therefore, hydraulic jumps while entering the pipes are not expected. This limits overtopping of the drainage terraces, which, if overtopped, may cause erosion of the intermediate cover. A structural energy dissipater with riprap will be placed at the downstream end of the pipes to reduce the discharge velocity (Figure 14).

Discharge from the terrace temporary drop pipes will be routed to an interim infiltration pond located in the mining area via perimeter piping or ditches. Based on information
provided by ERL, these perimeter structures will route a maximum of 8.9 acre-feet (387,684 cubic feet) of runoff to an interim pond (Figure 14). ERL also determined that the interim pond will have a size of 1.8 acres, a depth of 10 feet, and a capacity of 780,000 cubic feet. It is stated that the interim pond can be expanded as needed, and that pond overflow is also not a concern because the overflow water will remain within the mining excavation area and will infiltrate rather than discharge from the site.

Stormwater infiltration within the sedimentation basins and other stormwater controls is only a concern in the event of a release. Guidance provided by the facility's SPCC plan, will be followed, in the event of a known release, to prevent contaminated runoff from leaving the site and to minimize groundwater impacts from infiltration. The groundwater monitoring network will also be used as a tool to assess impacts from infiltration of a known release. The groundwater monitoring network will also be used as a tool to detect possible unknown releases.

The site will have stormwater controls to keep runoff from leaving the site. Permanent down-slope structures will be constructed when the limits of final cover extend to the location of those structures. Permanent sedimentation ponds will be constructed as soon as mining conditions allow. If the designated area for the permanent ponds is not available, an equivalent sized pond will be constructed in the mined area. Perimeter ditches of equivalent capacity to those shown on the final closure plans will route stormwater to the permanent ponds.

6.2.3.4 Closure Conditions

At closure, stormwater runoff is routed from the final cover to drainage terraces and down-slope structures that direct the runoff to perimeter ditches and piping. The perimeter ditches and piping route the runoff to permanent sedimentation basins P-1 and P-2 (Figure 15). A detailed discussion and analysis of the stormwater management plan for closure conditions is presented below.

Runoff generated on the east side of the final cover is directed to down-slope structures DS-1, DS-2, DS-3 and DS-4, and is routed to a perimeter ditch on the east side of the Landfill (Figure 15). The perimeter ditch flows to the south into sedimentation basin P-2 which is located at the southeast corner of the SDA. Sedimentation basin P-2 discharges into sedimentation basin P-1 located at the southwest corner of the SDA, which in turn discharges into the wetland located at the extreme southwest corner of the property.

According to the permit drawings, stormwater runoff generated on the west side of the final cover is directed to down-slope structures DS-5, DS-6, and DS-7, and DS-8. DS-5 and DS-6 terminate in retention areas on the west side of the Landfill (Figure 15). The retention areas serve as energy dissipaters and inlets to drainage pipes that convey the runoff south to a perimeter ditch that in turn discharges through two 48-inch concrete pipes to sedimentation pond P-1. DS-7 discharges to the same perimeter ditch. DS-8 discharges directly to sedimentation basin P-1.
The retention area at DS-5 outlets through two 24-inch concrete pipes. The retention area at DS-6 outlets through three 42-inch concrete pipes. The 24-inch and 42-inch pipes converge in a concrete structure to combine the flow into three 48-inch pipes that discharge to a perimeter ditch near DS-7.

The HydroCAD model routes the discharges from DS-5 through DS-7 differently. The HydroCAD analysis indicates that DS-5 discharges through the two 24-inch pipes, and that both DS-6 and DS-7 discharge into the three 42-inch pipes. That combined flow then discharges through a 2x4-foot channel (DS-7R) to the two 48-inch pipes that flow into sedimentation basin P-1.

6.2.4  Analysis of Surface Water Control Structures

The following discussion evaluates the quantity, quality and velocity of each stormwater control structure proposed for the final closure design.

6.2.4.1  Drainage Terraces

Drainage terraces will be constructed to direct the stormwater runoff to the appropriate down-slope structures. The grass-lined drainage terraces are designed to handle the flow for each sub-watershed in accordance with the NPDES Construction Site Storm Water Runoff Control guidance. The drainage terraces do not exceed 40-feet of vertical separation as required in the MPCA Slope Guidance Document. The drainage terraces were modeled using XP-SWMM Hydraulic Modeling for 25-year, 24-hour maximum and minimum sub-watershed flow rates. The results provided by Waste Management are presented in Table 6-2. The results are based on a drainage terrace bed slope of 3 percent, a 4 Horizontal to 1 Vertical (4H:1V) inside slope, a 16H:1.5V outside slope and a Manning’s “n” of 0.035.

Table 6-2 Drainage Terrace Modeling Results

<table>
<thead>
<tr>
<th>Flow Rate (25-year, 24-hour Storm Event)</th>
<th>Flow (cfs)</th>
<th>Peak Flow Depth (ft)</th>
<th>Velocity (ft/sec)</th>
<th>Erosion Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>4.5</td>
<td>0.5</td>
<td>2.8</td>
<td>Grass</td>
</tr>
<tr>
<td>Maximum</td>
<td>41.3</td>
<td>1.1</td>
<td>4.9</td>
<td>Grass</td>
</tr>
</tbody>
</table>

The modeling results provided by ERL indicate that the peak flow depths do not exceed the depth of the terrace (1.5ft). The velocities do not exceed five ft/sec as required by NPDES Construction Site Storm Water Runoff Control guidance and BMPs.

6.2.4.2  Down Slope Structures

There are eight gabion-lined down slope structures proposed at various locations around the perimeter of the landfill as part of the closure design. The down-slope structures are designed to handle each sub-watershed’s flow from the contributing drainage terraces. Energy will be dissipated upstream of access road crossings with a line of gabions.
perpendicular to flow and at the toe of the slope. Flow will be forced over the perpendicular gabions and will dissipate on gabion splash pads.

Flow depths and velocities of the gabion-lined down slope structures were modeled, using HydroCAD, by ERL for 25-year and 100 year, 24-hours storm events. Table 6-3 summarizes flow depths and velocities associated with the down-slope structures. The results are based on a bed slope of 33 percent, an 8-foot bottom width, 3H:1V side slopes and a Manning’s “n” value of 0.035.

<table>
<thead>
<tr>
<th>Drainage Structure</th>
<th>Description</th>
<th>Actual Channel Depth (ft)</th>
<th>25-year, 24-hour Event Final Construction</th>
<th>100-year, 24-hour Event Final Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Peak Flow Depth (ft)</td>
<td>Velocity (avg/max) ft/sec</td>
</tr>
<tr>
<td>DS-1-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.35</td>
<td>2.7/11.0</td>
</tr>
<tr>
<td>DS-1-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.52</td>
<td>2.2/9.2</td>
</tr>
<tr>
<td>DS-2-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.29</td>
<td>2.3/9.4</td>
</tr>
<tr>
<td>DS-2-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.35</td>
<td>2.2/9.2</td>
</tr>
<tr>
<td>DS-3-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.31</td>
<td>1.9/8.0</td>
</tr>
<tr>
<td>DS-3-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.31</td>
<td>2.2/9.3</td>
</tr>
<tr>
<td>DS-4-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.31</td>
<td>2.3/8.9</td>
</tr>
<tr>
<td>DS-4-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.41</td>
<td>2.9/11.5</td>
</tr>
<tr>
<td>DS-5-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.38</td>
<td>3.1/11.8</td>
</tr>
<tr>
<td>DS-5-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.46</td>
<td>3.2/12.8</td>
</tr>
<tr>
<td>DS-6-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.33</td>
<td>2.2/9.1</td>
</tr>
<tr>
<td>DS-6-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.37</td>
<td>2.4/10.5</td>
</tr>
<tr>
<td>DS-7-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.31</td>
<td>2.2/9.4</td>
</tr>
<tr>
<td>DS-7-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.36</td>
<td>2.3/10.0</td>
</tr>
<tr>
<td>DS-8-Uppr</td>
<td>Gabion-Lined Channel</td>
<td>1</td>
<td>0.28</td>
<td>1.8/7.9</td>
</tr>
<tr>
<td>DS-8-Lower</td>
<td>Gabion-Lined Channel</td>
<td>1.5</td>
<td>0.51</td>
<td>2.4/9.9</td>
</tr>
</tbody>
</table>
Down-slope peak flow depths do not exceed the down-slope channel depths for the 25-year 24-hour event or the 100-year 24-hour event.

### 6.2.4.3 Perimeter Ditches

The purpose of the perimeter ditches is to direct the stormwater runoff from down-slope structures to the sedimentation basins for treatment. The perimeter ditches are grass-lined and located around the perimeter of the landfill.

The perimeter ditch flow velocity was modeled using XP-SWMM by ERL. The model inputs included the ditch geometry, a Manning’s “n” of 0.035 and a 64.4 cubic feet per second (cfs) flow event. The modeling results indicate that the velocity will be 4.37 ft/sec; the peak flow depth will be 0.81 feet, which is less than the 6-foot perimeter ditch depth. The velocity is also less than five ft/sec as required by NPDES Construction Site Storm Water Runoff Control guidance and BMPs.

### 6.2.4.4 Sedimentation Basins Storage Analysis

Based on information provided by ERL, the sedimentation basins are designed to incorporate the volume of 0.5-inch of erosion from the entire SDA final cover area as sediment storage within the basins. The design parameters and total storage capacity for the sedimentation basins are listed in Table 6-4 below.

<table>
<thead>
<tr>
<th>Table 6-4 Sedimentation Basin Design Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>P-1</td>
</tr>
<tr>
<td>P-2</td>
</tr>
</tbody>
</table>

¹The P-1 top elevation in the permit documents is 1000. However, the hydroCAD analysis uses 998.

Table 6-5 presents the results from routing the 25-year and 100-year, 24-hour storm events through the sedimentation basins provided by ERL.

<table>
<thead>
<tr>
<th>Table 6-5 Sedimentation Basin HydroCAD Modeling Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Event</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>25-year</td>
</tr>
<tr>
<td>25-year</td>
</tr>
<tr>
<td>100-year</td>
</tr>
<tr>
<td>100-year</td>
</tr>
</tbody>
</table>

As presented in Table 6-5 above, the peak elevations do not exceed the top elevations of basins P-1 or P-2 for the 25-year and/or 100-year, 24-hour storm events.
6.2.4.5 Outlet Flow Velocity Analysis

Table 6-6 summarizes flow velocities associated with basin outlets and other drainage structures that are part of the SDA design.

Table 6-6 Flow Velocities Associated with Basin Outlets and other Drainage Structures

<table>
<thead>
<tr>
<th>Drainage Structure</th>
<th>Outlet Description</th>
<th>Outlets to</th>
<th>25-year, 24-hour Event Final Construction Velocity (avg/max) ft/sec</th>
<th>100-year, 24-hour Event Final Construction Velocity (avg/max) ft/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1 Outlet</td>
<td>18-inch CPEP</td>
<td>Wetland Located in the Southwest Corner of the Site</td>
<td>5.8 (max) 6.8 (max)</td>
<td></td>
</tr>
<tr>
<td>P-2 Outlet</td>
<td>18-inch CPEP</td>
<td>P-1</td>
<td>4.6 (max) 5.4 (max)</td>
<td></td>
</tr>
<tr>
<td>DS-5P Outlet (retention area)</td>
<td>Two 24-inch RCPs</td>
<td>Concrete structure then to three 48-inch pipes</td>
<td>3.8 (max) 3.8 (max)</td>
<td></td>
</tr>
<tr>
<td>P-4 Outlet (retention area)</td>
<td>Three 42-inch RCP to the south</td>
<td>Concrete structure then to three 48-inch pipes</td>
<td>5.4 (max) 5.8 (max)</td>
<td></td>
</tr>
<tr>
<td>DS-7R</td>
<td>2' by 4' Channel</td>
<td>Grass-lined Perimeter Ditch</td>
<td>4.1 (max) 4.5 (max)</td>
<td></td>
</tr>
<tr>
<td>Culvert under the Access Road</td>
<td>Two 48-inch Pipes</td>
<td>Grass-lined Perimeter Ditch</td>
<td>1.6/8.7 1.7/9.5</td>
<td></td>
</tr>
<tr>
<td>SW Wetland Outlet</td>
<td>18-inch CPEP</td>
<td>County Ditch 21 wetland Complex</td>
<td>5.6 (max) 6.6 (max)</td>
<td></td>
</tr>
</tbody>
</table>

A discrepancy exists within the Solid Waste Permit Application regarding stormwater control structure DS-7R. The description of DS-7R within the text consists of three 48-inch pipes whereas the HydroCAD analysis description for DS-7R includes a 2x4-foot channel. This discrepancy should be addressed prior to permitting to ensure the modeling results meet design criteria.

NPDES Construction Site Storm Water Runoff Control guidance and MPCA BMPs require the outlet velocity be less than or not exceed that of the receiving channel. The permit drawings indicate that riprap is to be placed at culvert entrances and exits for energy dissipation and velocity reduction.
6.2.5 Impacts to Wetland in Southwest Corner of SDA Site
This section addresses the quantity, quality and velocity changes and potential impacts to
the southwest wetland onsite as a result of the SDA.

6.2.5.1 Existing Conditions
The existing conditions are representative of current mining operations. Based on
information provided by ERL, the existing condition stormwater runoff volume generated
onsite for a 25-year, 24-hour event and 100-year, 24-hour event is 14.6 ac-ft and 23.1 ac-
ft, respectively. The stormwater runoff water entering the southwest wetland, during the
pre-landfill phase, after the 25-year and 100-year, 24-hour storm events is 10.43 cfs and
22.83 cfs, respectively.

6.2.5.2 Initial Construction of SDA
The initial construction phase includes the filling of Cell 17 and construction of Cell 18
(Figure 13). Stormwater generated during initial construction will be piped to an interim
pond located south of the active cells. However, after final cover is placed on Cell 17,
stormwater generated on the final slopes of Cell 17 will be routed north and managed
using operations outlined within the existing ERL Stormwater Permit. Runoff from
construction and operation of Cell 18 is to be managed in an infiltration pond in the
mining area and will not be discharged from the site as runoff. An increase in hydraulic
and sediment loading to the small wetland in the southwest corner of the SDA is not
expected during the initial construction phase.

6.2.5.3 Interim Conditions (ongoing operation and development)
At some point during the interim conditions phase, permanent sedimentation basins will
be constructed and put into service for treatment of runoff from the SDA. The
sedimentation ponds will minimize the amount of sediment-laden runoff that enters the
wetland located in the southwest corner of the site. If the designated area for the
permanent ponds is not available, an equivalent sized temporary pond will be constructed
in the mined area. Perimeter ditches of equivalent capacity to those shown on the final
closure plans will route stormwater to the temporary ponds.

6.2.5.4 Closure Conditions
A sedimentation basin consists of three zones: an inlet zone, a main treatment zone, and
an outlet zone. In order for a sedimentation basin to operate effectively, the flow path
from inlet to outlet should run through a quiescent main treatment area. The outlet zone
should also be a quiescent zone to allow final settling and prevent re-suspension of
sediments. In the case of sedimentation basin P-1, the inlet for stormwater runoff from
the west side of the landfill is located at the same end of the basin as the outlet. In order
for sedimentation basin P-1 to operate effectively, the relative positions of the inlet from
the west side of the landfill and the outlet to the wetland at the southwest corner of the
site must be separated by the main treatment zone of the basin. The flow path to the
outlet does not pass through the main treatment area. In addition, the entrance velocities
do not exceed the culverts and down-slope structure DS-8 are likely to scour and re-
suspend accumulated sediment. These issues should be addressed prior to permitting to ensure sedimentation basin P-1 is providing effective sediment removal treatment.

The remainder of this section provides an analysis of the theoretical performance of sedimentation basin P-1 with the presumption that the required flow path through the basin exists.

The NPDES General Permit for Construction Activity requires wet sedimentation ponds discharge at no greater than 5.66 cfs per surface acre of pond for the water quality volume event (2.5-inches over 24-hours). 5.66 cfs is the maximum flow rate for 90% sediment removal efficiency. The P-1 outlet discharge for the 2.5-inch rainfall event is 5.54 cfs. The P-1 surface area at the invert elevation (989.0 feet) is 42,743 square feet. The resulting discharge ratio is 5.65 cfs per surface acre of pond which is less than the requirement of 5.66 cfs per surface acre of pond. Therefore the sediment removal efficiency is in accordance with Part III.C.1.c of the NPDES General Permit for Construction Activity.

Table 6-7 presents a storage analysis for the southwest wetland by comparing existing conditions and closure conditions. The stormwater runoff entering the southwest wetland, during after the 25-year and 100-year, 24-hour storm events is 16.88 cfs and 28.14 cfs, respectively.

<table>
<thead>
<tr>
<th>Rainfall Event (24-hour)</th>
<th>Existing Conditions Inflow (cfs)</th>
<th>Existing Conditions Peak Elevation (ft)</th>
<th>Existing Conditions Outflow (cfs)</th>
<th>Closure Inflow (cfs)</th>
<th>Closure Peak Elevation (ft)</th>
<th>Closure Outflow (cfs)</th>
<th>Increase in Peak Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-yr</td>
<td>10.43</td>
<td>952.84</td>
<td>0</td>
<td>16.88</td>
<td>955.10</td>
<td>9.89</td>
<td>2.26</td>
</tr>
<tr>
<td>100-yr</td>
<td>22.83</td>
<td>953.49</td>
<td>0</td>
<td>28.14</td>
<td>955.60</td>
<td>11.59</td>
<td>2.11</td>
</tr>
</tbody>
</table>

The discharge pipe from sedimentation basin P-1 is located about 100 feet from the receiving wetland with an overland slope of approximately 3H:1V from the pipe to the wetland. This outlet creates a point discharge that did not previously exist and may cause erosion along the flow path to the wetland and resultant sediment deposition in the wetland. Evaluation of the erosion potential and inclusion of control features based upon actual field conditions should be made prior to issuance of the Stormwater Permit.

6.2.5.5 Sediment Loading Analysis

This section presents a discussion on the quality of the stormwater runoff entering and potentially leaving the southwest wetland. A P-1 sediment removal analysis was completed using the 25-year and 100-year, 24-hour storm events using Stoke's Law. Stokes Law is an equation relating the terminal settling velocity of a smooth, rigid sphere...
in a viscous fluid of known density and viscosity to the diameter of the sphere when subjected to a known force field. It is used in the particle-size analysis of soils by the pipette, hydrometer, or centrifuge methods. Stokes Law is:

\[ v_s = \frac{g}{18\mu} (S - 1)D^2 \]

Where:

- \( v_s \) = Settling Velocity (cm/s)
- \( g \) = Acceleration of Gravity (981 cm/s²)
- \( \mu \) = kinematic viscosity of water (0.01 cm²/s)
- \( S \) = Specific Gravity (2.65)
- \( D \) = Minimum particle diameter to be settled (cm)

The settling velocity was calculated by dividing the 12-foot pond depth by the plug flow detention time (calculated by HydroCAD). The plug flow detention times and settling velocities are listed in Table 6-8 for the 2.5-inch rainfall event, 25-year, 24-hour event and the 100-year, 24-hour event. The minimum particle size to be settled for each rainfall event was calculated using the settling velocity and all other known parameters listed in the equation above. The results are presented in Table 6-8.

**Table 6-8 Sediment Removal Summary**

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Existing Conditions</th>
<th>Final Closure Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Natural Drainage Flow to Wetland (cfs)</td>
<td>Total Inflow to Wetland (cfs)</td>
</tr>
<tr>
<td>2.5-inch Event</td>
<td>Not Modeled</td>
<td>5.63</td>
</tr>
<tr>
<td>25yr Event</td>
<td>10.43</td>
<td>16.88</td>
</tr>
<tr>
<td>100yr Event</td>
<td>22.83</td>
<td>28.14</td>
</tr>
</tbody>
</table>

Based on the information presented in Table 6-8, the hydraulic loading to the southwest wetland will increase by 6.55 cfs and 5.31 cfs, respectively, after a 25-year and 100-year, 24-hour storm event, as a result of the SDA. This effect could be carried on to off-site wetlands as well. However, sedimentation basin P-1 will remove all particles larger than 0.00095 and 0.000896 for the 25-year and 100-year, 24-hour storm events, respectively, thus minimizing these impacts.
6.2.6 Impacts to Different Watersheds

Based on Minnesota Department of Natural Resources DataDeli GIS watershed data, three watersheds exist within the project site: 1) Trott Brook, 2) Tibbits Brook, and 3) an unnamed watershed located in the southern portion of the site (Figure 16). Drainage to the west of the watershed divide would be expected to flow toward the nearby Rice Lake wetland complex. However, due to the construction of the railroad along the western site boundary, surface-water runoff is not expected to flow directly into the complex. Surface-water runoff flowing east would have to travel a considerable distance outside of the proposed project area to enter the (intermittent) streams and drainage ditches that flow to the Trott Brook Watershed.

Revised Universal Soil Loss Equation Calculations were completed as part of the Scoping EAW process for the SDA. Information provided in the EAW indicates that the soil loss is 2.25 tons per acre per year for a vegetated condition. However, in the several days following cover soils grading with no vegetation established, the universal soil loss equation indicates a potential for a soil loss of 13.3 tons per acre per year. This case is only relevant for the time required following cover grading for vegetation to become established on intermediate and final cover areas.

Table 6-9 presents a summary of changes to watershed acreage and potential sediment loading as a result of mining activities and the SDA. Table 6-9 is based on the watershed delineation boundaries presented in Figure 12. Table 6-9 assumes the soil loss is 2.25 tons per acre per year as estimated for the vegetative condition.

<table>
<thead>
<tr>
<th>Watershed</th>
<th>RUSLE Vegetated Soil Loss Estimate Rate (tons/acre/year)</th>
<th>Existing Conditions (undeveloped and developed) (Approx. Acreage)</th>
<th>Existing Conditions Sediment Loading Estimate (tons/year)</th>
<th>Final Construction (undeveloped and developed) (Approx. Acreage)</th>
<th>Final Construction Sediment Loading Estimate (tons/year)</th>
<th>Change in Acreage</th>
<th>Potential Changes in Sediment Loading Loss/Gain (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trott Brook</td>
<td>2.25</td>
<td>4.4</td>
<td>9.9</td>
<td>0</td>
<td>0</td>
<td>Loss of 4.4</td>
<td>Loss of 9.9</td>
</tr>
<tr>
<td>Tibbits Brook</td>
<td>42.4</td>
<td>95.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Loss of 42.4</td>
<td>Loss of 95.4</td>
</tr>
<tr>
<td>Unnamed</td>
<td>60.7</td>
<td>136.6</td>
<td>107.5</td>
<td>241.9</td>
<td></td>
<td>Gain of 46.8</td>
<td>Gain of 105.3</td>
</tr>
</tbody>
</table>

*Soil Loss Estimate = 2.25 tons/acre/year* approx. acreage (2.25 tons/acre/year * 4.4 acres = 9.9 tons/year)

As presented in Table 6-9 above, the acreage within Trott Brook and Tibbits Brook watersheds will decrease as a result of the closure phase of the Landfill expansion. The acreage within the unnamed watershed will increase as a result of the SDA. This increase could result in a potential increase in sediment loading to this watershed. However, the predominant sand and gravel soils in the vicinity of the SDA are porous, having relatively rapid infiltration rates. Consequently, surface-water runoff leaving the existing Landfill infiltrates within the existing ditches along the perimeter of the Landfill and surrounding...
road/railroad bed. Similar conditions are anticipated for the proposed SDA - with the majority of runoff from the SDA routed to sedimentation basins prior to being discharged from the site.

6.2.7 Impacts to Rice Lake Tibbits Brook Wetland Complex

Based on available information and resources, the construction of the railroad tracks west of the SDA changed the natural watershed boundary and flow of the Rice Lake/Tibbits Brook Watershed (Figure 16). Stormwater runoff from the SDA within the Tibbits Brook watershed will likely flow north and be managed by existing facilities during the initial construction phases. The majority of the stormwater runoff will be treated and then directed to the wetland located in the southwest corner of the SDA and unnamed watershed during ongoing operation and final closure conditions. Direct drainage routes from the wetland located in the southwest corner of the SDA to the Rice Lake/Tibbits Brook wetland complex have not been identified. Any water directed north during ongoing operations and development and closure conditions will be managed by existing facilities.

There does not appear to be a drainage route from the SDA to the Rice Lake/Tibbits Brook wetland complex. Therefore impacts to the Rice Lake/Tibbits Brook wetland complex are not anticipated as part of the development of the SDA.

6.2.8 Additional Mitigation Measures

The DS-7R drainage structure description in the Solid Waste Permit Application text consists of three 48-inch pipes. The DS-7R description in the HydroCAD analysis consists of a 2x4-foot channel. This discrepancy should be addressed prior to permitting to ensure the modeling results meet design criteria.

It is not apparent that the location and elevation of the outlet pipe from the wetland located at the southwest corner of the site and County Ditch 31 is based upon a delineation of the wetland. The location and elevation should be designed so as not to affect the existing hydrology of the wetland nor excavate the wetland.

The inlet and outlet locations for sedimentation basin P-1 should be reconfigured so that the flow path between them passes through the main treatment zone of the basin.

The potential for erosion and need for control features between the outlet from sedimentation basin P-1 and the wetland should be evaluated.
6.3 Air Quality

This section discusses potential environmental impacts to air quality, specifically the generation and control of landfill gas (LFG). This section of the EIS addresses the following issues as required in MPCA’s Final Scoping Decision Document:

- Sources of LFG;
- Existing Control Practices;
- Monitoring and Control Plans;
- Mitigation Measures.

6.3.1 Background

The following sections provide basic information about landfill gas – how it is produced, what it is composed of, and the conditions that affect its production.

6.3.1.1 Phases of Bacterial Decomposition of Landfill Waste

Bacteria decompose landfill waste in four phases. The composition of the gas produced changes with each of the four phases of decomposition. Landfills often accept waste over a 20- to 30-year period, so waste in a landfill may be undergoing several phases of decomposition at once (i.e. older waste in one area of the landfill might be in a different phase of decomposition than more recently buried waste in another area).

Phase I is associated with the initial placement of solid waste and accumulation of moisture with the landfill. During the first phase of decomposition, aerobic bacteria (bacteria that live only in the presence of oxygen) consume oxygen while breaking down the long molecular chains of complex carbohydrates, proteins, and lipids that comprise organic waste. The primary byproduct of this process is carbon dioxide. Nitrogen content is high at the beginning of this phase, but declines as the landfill moves through the four phases. Phase I continues until available oxygen is depleted. Phase I decomposition can last for days or months, depending on how much oxygen is present when the waste is disposed of in the landfill. Oxygen levels will vary according to factors such as how loose or compressed the waste was when it was buried.

Phase II decomposition starts after the oxygen in the landfill has been used up. Using an anaerobic process (a process that does not require oxygen), bacteria convert compounds created by aerobic bacteria into acetic, lactic, and formic acids and alcohols such as methanol and ethanol. The landfill becomes acidic. As the acids mix with the moisture present in the landfill, they cause certain nutrients to dissolve, making nitrogen and phosphorus available to the increasingly diverse species of bacteria in the landfill. The gaseous byproducts of these processes are carbon dioxide and hydrogen. If the landfill is disturbed, reintroducing oxygen, microbial processes will return to Phase I.

Phase III decomposition starts when certain kinds of anaerobic bacteria consume the organic acids produced in Phase II and form acetate, an organic acid. This process causes the landfill to become a more pH-neutral environment in which methane producing
bacteria become established. Methane- and acid-producing bacteria have a symbiotic, or mutually beneficial, relationship. Acid-producing bacteria create compounds for the methanogenic bacteria to consume. Methanogenic bacteria consume the carbon dioxide and acetate, too much of which would be toxic to the acid-producing bacteria.

Phase IV decomposition begins when both the composition and production rates of landfill gas remain relatively constant. Gas is produced at a stable rate in Phase IV, typically for about 20 years; however, gas may continue to be emitted for 50 or more years after the waste is placed in the landfill depending primarily on the availability of moisture with the landfill. Gas production might last longer, for example, if greater amounts of organics are present in the waste, such as at a landfill receiving higher than average amounts of domestic animal waste.

6.3.1.2 Characteristics and Generation of Landfill Gas

By volume, LFG typically contains 45-60% methane and 40 - 60% carbon dioxide. Landfill gas also includes small amounts of nitrogen, oxygen, ammonia, sulfides, hydrogen, carbon monoxide, and non-methanogenic organic compounds (NMOCs) such as trichloroethylene, benzene, and vinyl chloride. Table 6-10 lists “typical” landfill gases, their percent by volume, and their characteristics.

The type and rate of gas generation from a landfill depends on many factors, including waste composition, moisture content, pH, nutrient availability, and aerobic conditions. Initially, when waste is placed in a landfill, conditions are aerobic. Atmospheric oxygen is present and aerobic microorganisms begin to break down organic materials in the waste producing mainly carbon dioxide and water. These aerobic decomposition processes are exothermic (heat-producing) and the landfill temperature begins to rise. As the landfill ages, the oxygen is depleted and anaerobic (oxygen-deficient) conditions eventually predominate. Anaerobic microorganisms then continue the decomposition process, producing methane, carbon dioxide, and NMOCs. As the organic matter in the landfill is consumed, the rate of gas generation decreases. LFG production peaks about one year after waste placement and decreases 2% to 8% per year thereafter, depending primarily on the available moisture content in the waste mass. Wetter conditions accelerate the gas generation process and shorten the time span over which LFG is produced, while drier conditions slow down the generation rate and increase the generation time span.

Methane and carbon dioxide are the primary constituents of landfill gas. Methane is colorless and odorless. It is lighter than air and highly combustible. Carbon dioxide is a very common gas, colorless and odorless, heavier than air, and non-combustible. Although carbon dioxide is heavier than air and methane is lighter than air, they are generated together, tend to travel together, and generally are found in a relatively uniform mixture throughout the landfill.
The NMOC constituents and trace gas concentrations in LFG are a function of the types of refuse in the landfill and rate of anaerobic decomposition of the waste. It is the NMOCs and trace gases in LFG that give it an odor.

Table 6-10  Typical Landfill Gas Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent by Volume</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>45-60</td>
<td>Methane is a naturally occurring gas. It is colorless and odorless. Landfills are the single largest source of U.S. man-made methane emissions.</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>40-60</td>
<td>Carbon dioxide is naturally found at small concentrations in the atmosphere. It is colorless, odorless, and slightly acidic.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2-5</td>
<td>Nitrogen comprises approximately 79% of the atmosphere. It is odorless, tasteless, and colorless.</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.1-1</td>
<td>Oxygen comprises approximately 21% of the atmosphere. It is odorless, tasteless, and colorless.</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.1-1</td>
<td>Ammonia is a colorless gas with a pungent odor.</td>
</tr>
<tr>
<td>NMOCs (non-methanogenic organic compounds)</td>
<td>0.01-0.6</td>
<td>NMOCs are organic compounds (i.e. compounds that contain carbon). Methane is an organic compound but is not considered an NMOC. NMOCs may occur naturally or be formed by synthetic chemical processes. NMOCs most commonly found in LFG include acrylonitrile, benzene, 1,1-dichloroethane, 1,2-cis dichloroethylene, dichloromethane, carbonyl sulfide, ethyl-benzene, hexane, methyl ethyl ketone, tetrachloroethylene, toluene, trichloroethylene, vinyl chloride, and xylenes.</td>
</tr>
<tr>
<td>Sulfides</td>
<td>0-1</td>
<td>Sulfides (e.g. hydrogen sulfide, dimethyl sulfide, mercaptans) are naturally occurring gases that give the landfill gas mixture its rotten-egg smell. Sulfides can cause unpleasant odors even at very low concentrations.</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0-0.2</td>
<td>Hydrogen is a common, odorless, and colorless gas.</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>0-0.2</td>
<td>Carbon monoxide is an odorless, colorless gas.</td>
</tr>
</tbody>
</table>

6.3.2  Applicable Regulations

This section provides a summary of applicable regulations that ERL must comply with to control LFG emissions. Applicable state and federal regulations are described below in more detail.
Many state and local governments have regulated landfills since the middle of the twentieth century; however, before 1979, regulation and enforcement varied widely from site to site. In 1979, the federal government began regulating the siting, construction, operation, and closure requirements for landfills under the Resource Conservation and Recovery Act (RCRA). Subtitle D of RCRA addresses MSW and non-hazardous landfills. In 1996, the Environmental Protection Agency (EPA) finalized regulations under the Clean Air Act (CAA) – the New Source Performance Standards (NSPS) – that address methane and NMOC emissions from MSW landfills.

The ERL has an overall waste disposal capacity exceeding 2,500,000 cubic meters and is, therefore, subject to the NSPS for municipal solid waste landfills. Calculations of non-methanogenic organic compounds (NMOC) emissions from the facility indicated facility emissions would exceed 50 megagrams per year (Mg/year) in February 2001, necessitating that the site submit a collection and control system design plan within one year of that date. An NSPS Collection and Control System Design Plan/Surface Monitoring Plan (NSPS Plan) was prepared for the ERL by EarthTech, Inc., of Oak Brook, Illinois and was submitted to the MPCA for approval in July 2001. Supplemental materials were submitted to the MPCA in May, June, and July 2002. The NSPS plan was approved by the MPCA in a letter dated December 10, 2002. On March 29, 2004, the ERL was issued a Part 70 (Title V) Air Emissions Operating Permit ( Permit number 14100041-001) which authorizes the ERL to operate a municipal solid waste landfill with a landfill gas collection system.

6.3.2.1 Subtitle D

Subtitle D of RCRA addresses non-hazardous solid wastes. Under Subtitle D, the state and local governments are the primary planning, permitting, regulating, implementing, and enforcement agencies for management and disposal of household and industrial or commercial non-hazardous solid wastes. EPA establishes technical design and operating criteria (which, at a minimum, the States include in their own regulations) for disposal facilities. Also, per Subtitle D, EPA must determine the adequacy (approval status) of the State permit programs.

EPA’s minimum national technical criteria (regulations) include specific requirements for location, operation, design (liner, leachate collection, run-off controls, etc), groundwater monitoring, corrective action, closure and post-closure care, and financial assurance responsibility. The primary regulations are found in 40 CFR Part 257 and Part 258. The EPA has also issued regulations under the CAA that apply to emissions from very large landfills, and certain EPA criteria issued under the Clean Water Act may apply.
6.3.2.2 Minnesota Solid Waste Permit

Active landfills in Minnesota are regulated by Minn. R. chs. 7001 and 7035. They actively accept, under the terms and conditions of a MPCA permit, certain types of wastes for disposal. The ERL is permitted as an open landfill and is obligated to follow the requirements of Solid Waste Permit #74 (SW-74). Some of the requirements relating to LFG issues are:

- The Permittee must design, operate and maintain a gas monitoring, collection, and treatment system to meet the requirements of Minn R. 7035.2815, subp11.
- The Permittee shall develop and implement an odor control plan as part of the approved contingency action plan for the facility.
- The Permittee shall maintain a 24-hour telephone line to record any odor complaints from the neighbors surrounding the facility. The Permittee shall check the phone line at least once every twelve (12) hours each day, seven days per week, and log in all odor complaints received. The Permittee shall respond (sic) to all odor complaints within 24 hours of receipt. The Permittee shall record the response taken in the facility log book. This information shall be submitted to the MPCA as part of the Quarterly Operating Report.
- Landfill gas quantity and quality monitoring must be conducted on at least a quarterly basis and must include the monitoring identified in the Limits Tables(s) of this permit or approved Sampling Plan.
- Ambient air monitoring shall be conducted in accordance with the facility’s Title V Air Quality Permit on at least a quarterly basis.

6.3.2.3 Title V Air Quality Permit/ New Source Performance Standards

In 1996, the EPA, under the authority of the CAA, promulgated rules for the control of emissions from MSW landfills (40 CFR Part 60). The NSPS require periodic calculation of the annual NMOC emission rate at each facility with a maximum disposal capacity greater than or equal to 2.5 million Mg or 2.5 million cubic meters. Those facilities that emit more than 50 Mg/yr or NMOCs are required to install controls. Administration of the NSPS is delegated to the MPCA.

NSPS provides a tier system for calculating whether the NMOC emission rate is less than or greater than 50 Mg/yr, using a first-order decomposition rate equation. The tier system does not need to be used if the owner or operator has or intends to install controls that would achieve compliance.

NSPS requires the reduction of MSW landfill emissions from new and existing MSW landfills emitting 50 Mg/yr of NMOC or more with: 1) a well-designed and well-operated gas collection system, and 2) a control device capable of reducing NMOCs in the collected gas by 98 percent (by weight).

A well-designed and well-operated collection system shall, at a minimum: 1) be capable of handling the maximum expected gas generation rate; 2) have a design capable of
monitoring and adjusting the operation of the system; and 3) be able to collect gas effectively from all areas of the landfill that warrant control. Over time, new areas of the landfill will require control, so collection systems should be designed to allow expansion by the addition of further collection system components to collect gas or separate collection systems will need to be installed as the new areas require control. The design plans must meet certain requirements and be signed by a professional engineer, and are subject to MPCA approval.

The NSPS-required collection and control system design plan is based on the final grades of the landfill. The phased installation of the collection and control system as the landfill is filled will ultimately produce the design specified in the plan. Until the landfill has attained final grades, the collection and control of landfill gas pursuant to the NSPS may be accomplished using methods not specifically included as part of the final design (i.e., passive flares, vents, trenches). However, once the facility has reached the final grades, the collection and control system must meet the criteria specified within the design plan.

The NSPS rules require monitoring of surface emissions to ensure the proper operation of collection system equipment. In addition, a negative pressure must be maintained at all wells, except under specified conditions. Monitoring is to be done quarterly, with provisions for increasing monitoring and corrective procedures if readings above 500 parts per million (ppm) methane are detected. Instrumentation specification, monitoring frequencies, and monitoring patterns have been structured to provide clear and straightforward procedures that are the minimum necessary to assure compliance.

6.3.2.4 Surface Emissions Monitoring Plan

Part 40 CFR 60.755(c) requires that the landfill owner or operator conduct surface testing for methane around the perimeter of the collection area and along a pattern that traverses the landfill at 30-meter intervals. In addition, those areas that indicate elevated concentrations of LFG by visual observation (i.e. cracks or seeps in the landfill’s cover and distressed vegetation) must also be monitored. The surface monitoring route is subject to change over time to reflect development of the facility and changes in operation.

The purpose of the surface monitoring is to ensure that the operation of the gas extraction system results in surface methane concentrations of less than 500 ppm above background. Areas with steep side slopes or other dangerous areas (roads, active area, and truck traffic areas) are excluded from surface testing. However, they are visually inspected for evidence of LFG emission by the technician conducting the scan (i.e. distressed vegetation, hissing sounds, leachate seeps, etc.). If these indicators are present, the technician will perform a scan in that area.

6.3.2.5 Startup, Shutdown, and Malfunction Plan

MSW facilities subject to 40 CFR 63, Subpart AAA, the National Emission Standards for Hazardous Air Pollutants (NESHAP) for MSW landfills are required to prepare a Startup, Shutdown, and Malfunction Plan (SSM Plan) that meets the requirements of 40 CFR
63.6(e)(3). The SSM Plan must describe, in detail, procedures for operating and maintaining the emission source during periods of startup, shutdown, and malfunction; a program of corrective action for malfunctioning processes; and air pollution control and monitoring equipment used to comply with the relevant standard. The purpose of the SSM Plan is to:

- Ensure that, at all times, the MSW landfill owner or operator operates and maintains the affected source, including associated air pollution control and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions to the levels required by the relevant standards; and
- Ensure that MSW landfill owners or operators are prepared to correct malfunctions as soon as practicable after their occurrence in order to minimize excess emissions of hazardous air pollutants.

6.3.3 Landfill Gas Collection and Control System Components

Landfill gas collection systems are either active or passive systems. Active collection systems provide a pressure gradient in order to extract LFG by use of mechanical blowers or compressors. Passive systems allow the natural pressure gradient created by the increase in landfill pressure from LFG generation to mobilize the gas for collection.

Landfill gas control and treatment options include: 1) combustion of the landfill gas, and 2) purification of the landfill gas. Combustion techniques include those that do not recover energy (e.g. flares), and those that recover energy (e.g. gas turbines and internal combustion engines) and generate electricity from the combustion of the LFG. Boilers can also be employed to recover energy from LFG in the form of steam. Flares involve an open combustion process that requires oxygen for combustion, and can be open or enclosed. Purification techniques can also be used to process raw LFG to pipeline quality natural gas by using adsorption, absorption, and membranes.

6.3.3.1 Extraction Wells

The first step in designing a gas system is to lay out the location of the gas extraction wells. Well spacing is also the first requirement listed under 40 CFR 60.759, Specifications for Active Collection Systems: “Each owner or operator seeking to comply with § 60.752(b)(i) should site active collection wells, horizontal collectors, surface collectors, or other extraction devices at sufficient density throughout all gas producing areas....”

Generation of LFG creates pressure inside the landfill higher than surrounding ambient pressure. If no landfill gas controls are present, the generated gas will naturally travel toward areas of lower pressure, i.e. outward from the landfill to the atmosphere. A LFG control system is designed to create zones of low pressure (relative to ambient) within the landfill so that the natural travel direction of generated gas is inward toward the low-pressure zones inside the landfill rather than outward to the atmosphere.
The low-pressure zones are created by applying a vacuum on gas extraction wells placed in the landfill. The effect of the well vacuum extends for some distance away from the well (referred to as the Radius of Influence, or ROI). The ROI depends upon many factors, including the diameter and depth of the well, length of well screen, the strength of the applied vacuum, the porosity and moisture content of the waste, and the rate of gas generation. The ROI for a well has a cylindrical shape, positioned concentric with the well. The edge of the ROI is reached when the pull of the vacuum applied to the well is zero (i.e. the distance from the well where LFG will no longer travel toward the well).

The strength of the vacuum on any individual well must be limited so that ambient air is not drawn into the landfill through the cover. Air intrusion is undesirable because the introduction of oxygen creates an environment toxic to the anaerobic methanogenic bacteria that produce LFG, which reduces the rate and lengthens the time of gas generation. Air intrusion may also cause the temperature in the landfill to increase due to high levels of aerobic biologic activity, and can result in subsurface fires within the landfill.

Usual design practice for determining the gas well layout includes plotting well locations on a topographic map of the landfill, calculating and plotting the ROI around each well, then adjusting well locations to eliminate gaps in ROI coverage. Due to the cylindrical shape (circular in plan view) of the ROI, eliminated gaps in coverage also produces overlaps of adjacent circles. This designed overlap provides some factor of safety to accommodate the uncertainties inherent in landfill gas flow analysis due to the heterogeneous nature of the waste.

6.3.3.2 Blower/Compressor

Part 40 CFR 60.752(b)(2)(ii)(A)(1) requires the active gas extraction system be designed to handle maximum expected gas flow rate from the entire area of the landfill that warrants control, over the intended use period of the gas control system equipment. Part 40 CFR 60.752(b)(2)(ii)(A)(3) requires that gas be collected at a sufficient extraction rate.

The blower/compressor is the single component that provides the vacuum that actually extracts the gas from the well field and moves it through the system. The blower/compressor must provide a uniform source of vacuum over a wide range of flow rates, since gas flow volumes will vary over the life of the gas extraction system. Minimum system flows are those expected when only the initial phases of the system have been installed. Maximum flows will occur after the entire gas control system is in place.

The blower/compressor must be capable of providing sufficient negative pressure to overcome pressure drops and flow resistance in the system at the maximum gas flow rate, as well as supplying sufficient positive pressure for delivery of the collected gas to the control device.
6.3.3.3 Control Device

A control device (flare, internal combustion engine, etc) must meet the requirements of 40 CFR 60.752(b)(2)(iii) and be capable of combusting a wide range of flow volumes.

6.3.4 Landfill Gas Emissions Estimation for ERL

The LFG extraction system is sized based upon current and future projections of LFG that will be generated and recovered from the landfill. Critical information needed for system sizing includes: quality and quantity of LFG generated by the landfill; and given an installed LFG system, the amount of recoverable gas. These key parameters are estimated using a combination of gas generation/yield modeling, field testing, and engineering experience and judgment.

The rate of emissions from a landfill is governed by gas production and transport mechanisms. To estimate uncontrolled emissions of the various compounds present in landfill gas, total landfill gas emissions must first be estimated. Uncontrolled methane emissions may be estimated for individual landfills by using a first-order kinetic model of methane production developed by the EPA. The maximum landfill gas generation rate for the existing Landfill and the SDA was estimated using the EPA’s Landfill Gas Emission Model (LandGEM) Version 2.01. The model is based on the following equation:

\[ Q_m = \sum_{i=1}^{n} 2kL_0 M_i (e^{-kt}) \]

where:

- \( Q_{CH4} \) = methane generation rate at time \( t \), m³/yr
- \( k \) = methane generation rate constant, yr⁻¹
- \( L_o \) = methane generation potential, m³ CH₄/Mg refuse
- \( M_i \) = mass of solid waste in the \( i^{th} \) section, Mg
- \( e \) = base Log, unitless
- \( t \) = time since the initial refuse placement

Site-specific landfill information is generally available for variables \( M_i \) and \( t \). Values for variables \( L_o \) and \( k \) must be estimated. Estimation of the potential methane generation potential of refuse (\( L_o \)) is generally treated as a function of the moisture and organic content of the refuse. Estimation of the methane generation constant (\( k \)) is a function of a variety of factors including moisture, pH, temperature, other environmental factors, and landfill operating conditions.

The LandGEM model uses regulatory default values for \( L_o \) and \( k \) (170 m³/Mg and 0.05/yr, respectively). The default values are conservative on the side of over estimating emissions in order to protect human health, to encompass a wide range of landfills, and to
encourage the use of site-specific data. Use of site-specific $L_0$ and $k$ values rather than the default values would result in more accurate emissions estimates.

6.3.4.1 Current Landfill Gas Emissions

An NSPS design plan which included an estimate of the LFG emissions for the existing portion of the ERL was submitted to the MPCA in July 2001.

In lieu of site-specific testing for $L_0$ and $k$ values, ERL derived $L_0$ and $k$ values from a Waste Management database compiled from gas extraction tests conducted at Waste Management sites in the mid- to late-1980’s. The landfills in the database were sited across varying geographical regions of the United States in order to assess the effect of location and climate on gas generation rates. The site characteristics for ERL were compared to the landfill assessments in the database, and sites of similar geographic location, refuse volume, waste stream, and precipitation were selected for determining site-specific $L_0$ and $k$ values for ERL.

As a result of the comparison, a gas generation rate of 11.6 $m^3$/Mg (0.185 cubic feet per pound) of refuse per year and a theoretical total gas yield of 279.2 $m^3$/mg (4.5 cubic feet per pound) of refuse per year were thought to most closely approximate the conditions expected at ERL. Based upon the assumption that approximately 50 percent of LFG is comprised of methane, a $L_0$ value of 139.6 $m^3$/Mg refuse was derived for the ERL.

The methane generation rate constant $k$, is calculated by dividing the gas generation rate by the theoretical total gas yield. This results in a $k$ value of 0.0411/year for the ERL.

The mass of waste in the ERL, upon which gas production volumes are based, was taken from historical records of gate receipts from 1972 to 2000 and estimated gate receipts of 450,000 tons/year from 2001 until the site’s anticipated closure in 2012.

Based on the LandGEM output contained in the July 2001 NSPS Design Plan, a maximum gas generation rate of 4,045 cfm was estimated to occur in the year 2013.

6.3.4.2 Expansion Landfill Gas Emissions

The proposed expansion develops approximately 73.7 acres which includes approximately 8.66 acres on the southern-most portion of the existing landfill and 65.05 acres extending onto the 109-acre parcel of property located immediately to the south of the existing landfill. The proposed expansion will provide approximately 14,980,978 cubic yards of additional MSW disposal capacity and 17,534,979 cubic yards of total airspace (waste and cover).

The approved NSPS plan submitted in 2001 was used as the basis for continuation of the LFG management strategy for the analysis prepared for the Solid Waste permit amendment. The total estimated LFG generation rate for the entire landfill (existing plus expansion) was calculated using the LandGEM estimation model as described previously in this section. The waste mass database was comprised of historical gate receipts...
through the year 2000, an estimate of 450,000 tons/year for 2001, an estimate of 520,000 tons/year for 2002, and an estimated 550,000 tons/year for the years 2003 to 2023. The in-place density of the waste was estimated to be 1,400 pounds/yd$^3$. This results in a reported maximum gas generation rate of 6,658 cfm at the facility’s projected closure in 2023. This is an increase of approximately 2,613 cfm from the 2001 estimation.

6.3.5 Landfill Gas Management at ERL

Landfill gas emissions at ERL are controlled through an active gas collection system. In order to adequately control the expected LFG emissions, a properly designed and managed collection and control system is needed. The following sections discuss the current and future gas management systems at the ERL.

6.3.5.1 Current Gas Management System

The current gas management system at the ERL includes an active gas collection system incorporating a total of 50 existing and proposed gas wells, a collection piping network, a blower, three IC engines, and a flare. Collected gas is used to fuel three Caterpillar 3516 engines for the generation of electricity that is distributed to the community through a local electrical utility, Elk River Municipal Utilities. Each engine is capable of combusting approximately 300 cubic feet per minute (cfm) of gas, for a total existing engine capacity of approximately 900 cfm. Excess gas that cannot be used by the engines is distributed to an enclosed flare located adjacent to the landfill gas electrical generation facility capable of combusting 2,000 cfm.

The expected maximum gas flow rate was calculated to be 4,045 cfm (from NSPS Design Plan, 2001). Information provided by ERL indicates the existing blower to the flare can accommodate up to 3,000 cfm. By adding a height extension to the flare and an additional flange, ERL will modify the design capacity of the flare to accept up to 3,000 cfm of LFG.

The volume of gas currently extracted represents the minimum system volume, since flows will only increase as the landfill and gas system are expanded. Current landfill gas flows of 781 to 1,560 cfm (2004 data) have been measured at the flare station/gas plant. The lowest flow rates correspond to when the system was undergoing maintenance or encountering technical difficulties.

ERL, in conjunction with Elk River Municipal Utilities, are proposing to expand the landfill gas electrical generation facility by adding a fourth Caterpillar 3516 engine. The volume of gas currently generated at the Landfill is enough to support the installation of a fourth IC engine generator set. The proposal to expand the gas-to-energy facility is the subject of a separate environmental review (Environmental Assessment Worksheet) that will be public noticed in November, 2005.
6.3.5.2 Expansion Gas Management System

The LFG extraction system design presented in the 2001 NSPS plan is the basis for the design of the expansion LFG extraction system. The expansion LFG extraction system will be connected to and integrated with the existing LFG extraction system.

6.3.5.2.1 Extraction Well Radius of Influence

Spacing between individual gas wells is initially determined by mathematically calculating a radius of influence (ROI) for each well that defines the radial distance that will be influenced by application of a vacuum to the well head. The ROI is determined by application of Darcy’s equation for radial flow through a porous media.

Calculations completed for the 2001 NSPS Plan predicted LFG extraction well radius of influence of approximately 200 feet and a maximum assumed radius of influence of 225 feet. These assumptions were used to prepare a preliminary layout of 26 wells to provide coverage for the approximately 75 acres of proposed additional landfill footprint. Once the preliminary layout was complete, new ROI calculations for each well were completed based upon depth of the well in correlation with the location of the well on the expansion footprint. The locations of the wells were adjusted based upon the new ROI calculations to provide approximately 15% overlap of the ROI’s. The design ROI for the expansion wells range from 180 to 205 feet.

6.3.5.2.2 Extraction Well Flow Projections

Individual well gas flows were calculated using the same equations used in the EPA LandGEM, and consistent with the methods and base parameters used in the 2001 NSPS plan. Individual gas well flow rates calculated for each new well projected flows of 31 to 90 cfm per well. These projected flow rates were used to complete head loss calculations for header pipe sizing.

6.3.5.2.3 Header Pipe Sizing

The flow of compressible fluids in relatively low-pressure pipelines is often computed using the Spitzglass formula:

$$Q = 3550 \times K \times (h/S \times L)^{1/3}$$

Where:
- $Q$ = standard flow rate, ft$^3$/hr
- $h$ = pressure loss, in. W.C.
- $S$ = specific gravity of the compressible fluid, unitless
- $L$ = length of pipe, ft
- $K$ = Spitzglass pipe constant
The Spitzglass pipe constant is a function of pipe size:

\[ K = \left( \frac{d^5}{1+3.6/d+0.03*d} \right)^{1/2} \]

Where: \( d \) = inside pipe diameter, inches

This formula was used to calculate pipe sizes in the 2001 NSPS Plan and was used in the Request for Permit Modification for the Solid Waste permit. Additional head loss in the piping system due to valves and fittings is accounted for by adding an equivalent length of pipe.

Three design criteria have been established for the ERL for calculating minimum pipe size:

1. The velocity of the gas should not exceed 30 feet per second (ft/sec) within the pipe.
2. The velocity of the gas should not exceed 20 ft/sec within the pipe when there is countercurrent gas/liquid flow (the flow of the gas is opposite that of condensate which is typically drained from the system via gravity at design low points).
3. The maximum allowable pressure drop within the pipe should not be greater than one inch water column per 100 feet of pipe, or 0.01 inch water column per unit foot of pipe.

Calculations presented in the Request for Permit Modification indicate that the design criteria are met for the proposed expansion system. The resulting well field layout and header pipe configuration for the proposed expansion is illustrated on Figure 17.

Header pipes currently servicing the existing extraction system will need to be increased in size due to the increased flow and subsequent higher pipe velocities experienced as a result of the proposed expansion.

6.3.6 Ability to Control Projected LFG Emissions

As referenced above, the current collection and control system blower can accommodate flows up to 3,000 cfm. The current combined capacity of the Caterpillar engines and enclosed flare is approximately 2,900 cfm. It is possible, with modifications to the flare and adding a fourth engine, that the combined capacity of the combustion equipment can reach approximately 4,200 cfm.

The actual LFG recovery rate depends on the LFG collection system coverage (\( \% = \) radius of influence/landfill area) and LFG recovery system collection efficiency (depends on collector design and landfill characteristics). Although LFG collection systems are designed and sized to collect the maximum gas flow rate, it is unlikely that they will collect all the gas generated. The EPA and waste industry have reported that gas collection efficiencies can range from 60% to 85%, with 75% as an average value. Higher collection efficiencies are possible with the incorporation of a synthetic cap. ERL
reports that collection efficiencies at the existing Landfill are approximately 75% in un-
capped portions of the landfill and 90% in capped portions.

The proposed SDA LFG extraction system well layout consists of approximately one
well per 3 acres and provides coverage of approximately 71 acres of the 75 acre
expansion (95% areal coverage). The areas not covered by the ROI’s are primarily the
landfill sideslopes where waste depths are shallow and vertical extraction wells are not
feasible.

Adequate control of surface emissions can be demonstrated by periodic surface scans as
described in Section 6.3.2.4. Federal rules (40 CFR 60.753) require the operation of the
gas collection system such that the methane concentration at the surface is less than 500
ppm above background. If the methane concentrations are detected above the threshold
value, the LFG system is required to be adjusted or augmented to reduce emissions to
below the threshold value.

6.3.7 Additional Mitigation Measures

The maximum gas generation at the ERL will significantly surpass the current collection
and control system capacity. ERL has submitted a plan for expanding the LFG collection
and control system with the permit application. In addition, ERL will be updating the site
NSPS Plan to incorporate the expansion.

6.3.7.1 Extraction System Modifications

The SDA LFG extraction system will be connected to the existing LFG extraction
system. Header pipe sizes of the existing system need to be increased or new header
pipes installed to account for increased gas production and associated flow rates.
Pressure drop calculations for pipe re-sizing were included as part of the Request for
Permit Modification, however, associated figures showing the locations of the pipe
segments were not included.

The existing blower/compressor also will require replacing or modifying to increase
capacity. Likewise, additional control devices (i.e., engines, flares) will need to be
installed or alternative markets for the LFG will need to be developed. Should surface
scans indicate that emissions are exceeding threshold values, additional extraction wells
and/or alternative collection and control devices will need to be installed.

In addition, The NSPS Plan and corresponding Title V Air Permit along with the required
monitoring and sampling plans will need to be updated upon completion of the solid
waste permitting process.

6.3.7.2 Emissions Calculations

The 2004 Annual Operating Report states that the current MSW Permitted Capacity
(2003 Permit) is 13,951,200 cubic yards or 9,765,840 tons (assuming 1,400 lb/cubic
yard). The NSPS Design Plan submitted in 2001 uses 8,501,828 tons of MSW for
emissions calculations. These discrepancies will be addressed prior to landfill permitting.

A revised NSPS plan submitted in April 2005 (submitted after the Request for Permit Modification to MPCA Permit # SW-74 in February 2004) uses a disposal capacity of 12,351,767 tons for the existing MSW landfill emissions estimation. The revised NSPS Design Plan reports an increase of 1,232 ft$^3$/min in LFG emissions from 4,045 ft$^3$/min to 5,277 ft$^3$/min. The revised NSPS Plan also reports the anticipated closure year of the existing landfill to be 2021 vs. 2013 as reported in the 2001 NSPS Design Plan.

The calculated emissions reported in the 2004 Request for Permit Modification for the SDA are based upon the original NSPS Plan submitted in 2001 (as discussed in Section 6.3.4.2). The table preceding the LandGEM output in the Request for Permit Modification states in the header portion that the total airspace available (waste only) is 31,072,318 cubic yards. However, only 24,813,470 cubic yards of remaining airspace are shown in the first line of the calculation portion of the table, and only a cumulative total of 17,369,579 total tons of MSW are accounted for with an anticipated closure date of 2027. These discrepancies will be addressed prior to issuance of the landfill permit.

The LandGEM output included in the 2004 Request for Permit Modification uses a capacity of 14,173, 260 Mg (15,618,933 tons) and lists the anticipated closure date as 2023. Furthermore, the Engineering Report of the Request for Permit Modification states that the SDA would provide approximately 19 more years of capacity to the existing landfill. Using the 2001 NSPS Plan predicted closing date of 2013, this calculates to an anticipated closure date of 2032.

The EPA has released new LandGEM software as of May 2005 (Version 3.02) which replaces Versions 2.01 and 3.01. Differences between Versions 2.01 and 3.02 of LandGEM include:

- Version 3.02 uses a revised first-order decomposition rate equation that improves the accuracy of emission estimates over time, especially for landfills being modeled using higher methane generation rate (k) values.
- Version 3.02 allows users to model emissions of total landfill gas, which can be calibrated using user-specified methane content other than 50 percent.
- Version 2.01 uses metric units of measure exclusively, whereas Version 3.02 allows users to choose between several English (e.g., short tons, cubic feet) and metric (e.g., megagrams, cubic meters) units of measure for model inputs and outputs.
- Version 2.01 contains AP-42 default values and air pollutant concentrations and molecular weights that were current as of September 1997 (Supplement C of the 5th Edition). Version 3.02 contains revised AP-42 default values (within the inventory defaults), air pollutant concentrations, and molecular weights that are current as of November 1998 (Supplement E of the 5th Edition).
It is recommended that the LandGEM emissions estimations be recalculated and the discrepancies between documents be rectified prior to issuance of the Solid Waste Permit. In addition, year-specific disposal tonnages should be used for the years 2001 through 2004 instead of the estimated tonnages used in the Request for Permit Application.

6.4 Odor

During the scoping process for the EIS, local officials and citizens expressed concern for a potential increase in odors from the Landfill expansion. The ERL acknowledges that odors are a concern as part of operations of a solid waste facility. Therefore, this section of the EIS provides a discussion of the potential sources of odors and the mitigative measures that can and have been taken to minimize odors from the existing Landfill.

6.4.1 Sources of Odors

MSW landfills can emit odors in varying degrees from many potential sources that may include:

- Operations at the working face;
- Leachate collection systems;
- Landfill gas; and
- Construction activities.

6.4.1.1 Operations at the Working Face

Garbage disposed of at the “working face” (where waste is actively being placed) is a source of odor if not managed. Landfill odors may also be produced by the disposal of certain types of wastes. Odors can also be attributed to arriving and queuing hauling trucks, particularly those originating from transfer stations where waste is sometimes allowed to collect over a period of time in order to accumulate enough volume to haul economically.

The working face is also generally where most of the landfill vehicular traffic activity is concentrated. Exhaust odors from heavy equipment and haul trucks are most concentrated in this area.

6.4.1.2 Leachate Collection and Storage Systems

Water from precipitation that flows into garbage and percolates down to the bottom of the landfill picks up odors from the biological waste products of decomposition with which it comes into contact. The resulting leachate is collected in pipes running through the landfill, removed, and temporarily stored on site prior to being disposed of off site. As described in Section 6.3, landfill collection and storage systems are, by design, often vented to the atmosphere.
6.4.1.3 Landfill Gas (LFG)

Anaerobic decomposition of organic material produces LFG. LFG is made up primarily of methane and carbon dioxide (both odorless), but does contain small amounts of odorous compounds that the human nose can perceive at very low levels. Since landfills may produce a large amount of gas, offsite odors can result if gas management systems are not installed in time and operated effectively.

Potential sources of LFG odors include sulfides, ammonia, and certain NMOCs, if present at concentrations that are high enough. Odor-producing chemicals (i.e., hydrogen sulfide and ammonia) are not likely to produce long-term adverse health effects at the levels typically associated with landfill emissions.

6.4.1.4 Construction Activities

Certain construction activities, particularly where previously disposed waste may be excavated, may cause short-term odor emissions. For example, installation of landfill gas collection wells and piping exposes decomposing garbage for short periods of time. Odors produced as a result of construction activities dissipate after construction and restoration are complete.

6.4.2 Factors Influencing Odor Strength

Proximity to the landfill is generally the major factor in whether an odor is considered a nuisance. Other key issues that affect odor strength include:

- Type of waste – Certain wastes are more odorous than others.
- Volume of potentially odorous material – A small amount of odorous waste can be quickly covered, or may not be noticeable, while larger amounts spread over a wide area requires more active management.
- Time required to unload and cover – Waste that is covered quickly produces less odor.
- Meteorological and topographic conditions – Wind speed and direction, humidity, terrain, and precipitation have an influence on transporting odor offsite. Precipitation plays a large role in the production of odors at a landfill. More precipitation = more odors. Atmospheric pressure, wind speed and direction play a large role in the ability of landfill gas to migrate to off site receptors.
- Size of the working face – if the working face is small, daily cover can effectively limit odor transmission. The larger the working area, the more likely there will be offsite transmission of odor unless effective measures are taken.
- Time of day – Odor problems decrease when breezes are strongest, typically in the afternoon, because odors are dispersed in the wind.
6.4.3 Odor Testing at ERL

ERL, in association with Elk River Municipal Utilities (owners of the LFG co-generation plant) conducted odor evaluations at the Landfill on October 18, 2004 and March 16, 2005. Four potential sources of odors were evaluated:

- A leachate storage tank vent;
- Exhaust stacks from the LFG engines;
- Exhaust from the flare; and
- Breather vent from the internal combustion engines.

The evaluations included Detection and Recognition Threshold testing done in accordance with ASTM Standard Practice E679. Sensation and odor descriptors were also identified in an effort to characterize the odors. The subjective measure of Hedonic Tone, which is a measure of the pleasantness or unpleasantness of an odor sample, was also evaluated.

The odor evaluation included a series of sample testing by assessors (actual people), who make up an odor panel. The assessors follow a series of set procedure and protocols to determine the Detection and Recognition Thresholds, which are dilution ratios of the various samples. Dilution of an odorous emission is the physical process that occurs in the atmosphere down-wind of the odor source. The Detection Threshold is the number of dilutions needed to make the actual odor emission just detectable by the assessors. The Recognition Threshold is the dilution ratio at which the assessor first detects the odors character (“smells like…”).

Results of the Detection and Recognition Threshold tests indicate that the engine exhaust and the breather vent exhaust required the highest levels of dilution, more than double that of the leachate tank vent, and more than six times that of the flare exhaust. This indicates that the engine exhaust and the exhaust from the breather vent have the most detectable odor of the four sampling points.

Odors were detected at each of the locations (primarily chemical and petroleum type odors). The sensation and odor descriptors included in the evaluation characterize the odors from the four sample locations. These descriptors characterize the type of odors emitted by that source, such as the flare exhaust is described as having a chemical, burnt odor. The Hedonic Tone results indicate that the leachate tank vent and the breather vent exhaust had the most unpleasant odor of the four samples. However, the flow rate from the leachate tank vent is relatively insignificant in comparison to the exhaust from the engines, flare, and breather vent.

Emissions samples were obtained from the four locations at the same time that odor evaluations were performed and submitted for analytical testing. An additional sample of raw landfill gas was collected from a sampling port upstream of the flare.
Samples from the leachate tank vent included n-butyl mercaptan, which likely accounts for the majority of the odor identified at this location in the odor evaluation. Hydrogen sulfide along with some other sulfides were identified, but at relatively low concentrations, such that these parameters are not significant odor contributors. The only exception to this was the engine breather vent, where higher levels of hydrogen sulfide were found along with several sulfides and mercaptans, which account for the odor noted at this sample point.

The sample collected from the engine exhaust indicated a 95% reduction in hydrogen sulfide and an 80% reduction in carbonyl sulfide in comparison to the raw landfill gas. The hydrogen sulfide, which tends to have an odor like rotten eggs, is present due to incomplete combustion of LFG in the engines. The carbonyl sulfide, which tends to have a sour smell, is also a result of incomplete combustion of LFG. These compounds likely are responsible for odors experienced during the evaluation.

The sample collected from the flare exhaust indicated a 100% reduction in hydrogen sulfide and an 85% reduction in carbonyl sulfide in comparison to the raw landfill gas. Analytical testing results indicate that the emissions from each of the three locations do not exceed air quality permitted limits.

6.4.4 Emissions Monitoring at ERL

ERL routinely monitors and tests emissions from the landfill, enclosed flare, and landfill gas-to-energy plant as required by both the facility’s air quality and solid waste permits. Surface scans conducted by ERL have not indicated an exceedance of surface emissions standards. Performance testing of the enclosed flare and internal combustion engines indicate that emissions components are within permitted levels.

6.4.5 Odor Tracking

In accordance with the MPCA solid waste permit, odor complaint calls can be received at the ERL 24-hours a day by calling the facility’s posted phone number. After business hours, callers can leave a message, as messages are check regularly by staff. When a complaint is received, the County is also contacted. ERL staff investigate all the complaints.

ERL has also installed a weather station at the site in order to assess weather conditions (wind speed and direction, barometric pressure, etc.) at the time of the complaint. This information is being used to assess atmospheric conditions when odors may be most prevalent.
6.4.6 Odor Mitigation

The ERL employs several odor mitigation measures as part of the facility’s standard operating procedures. Such measures currently in place at the ERL include:

- Limiting the size of the working face, to reduce the amount of exposed waste;
- The use of daily and intermediate cover, placing cover materials on a continual basis, and ensuring that all waste is covered at the end of each day;
- Immediately covering pungent wastes and those wastes with the potential for strong odors;
- Use of leachate collection tanks in place of containment ponds, which assists in limiting the amount of odor from leachate;
- Installation and operation of an active gas system that is operated in accordance with an air quality permit;
- Installation of more landfill gas wells than required by NSPS regulations, which assists with odor control, especially in the leachate recirculation area; and
- Carefully coordinating construction activities which have the potential to increase odors, such that the amount of time garbage is exposed is limited. To the extent possible, the ERL attempts to have all exposed garbage covered at the end of each day.

Possible odor control devices include:

- Landfill gas collection and control – As discussed in Section 6.3.2.4 of this EIS, surface emission scans are required by permit for the ERL. Should surface emission scans indicate an emissions exceedance, the installation of additional gas extraction wells or alternative collection and control devices may be warranted.
- Chemical additives – Certain chemical compounds have been shown to produce reactions which reduce the formation of sulfides.
- Biofilters, activated carbon filters, ozone generators – These devices may reduce odors by producing chemical reactions to emissions compounds prior to being vented to the atmosphere.

6.5 Visual Impacts

This section discusses potential visual impacts of the SDA. The Final Scoping Decision Document identified eight specific locations and directions with the greatest sensitivity to visual impacts for analysis (Figure 18).

The Final Scoping Decision Document identifies three conditions for evaluation: the No-Build Alternative (unrendered image), 75 percent final height (with and without additional screening), and post-closure (with and without additional screening). The intention of the 75 percent final height condition was subsequently clarified to mean 75 percent of total capacity developed, in order to more accurately reflect the proposed...
sequential development plan. Thus the 75 percent developed condition reflects full-height development of about 75 percent of the SDA footprint.

### 6.5.1 Visual Impact Locations

Visual impacts were analyzed for the following locations:

- **#1** – 0.9 miles south of the intersection of Highway 169 and 221st Avenue from the northbound lane of Highway 169 looking to the north.
- **#2** – At the intersection of Highway 169 and 221st Avenue from Highway 169 looking to the northwest.
- **#3** – 0.3 miles north of the intersection of Highway 169 and 221st Avenue from the northbound lane of Highway 169 looking to the northwest.
- **#4** – 0.9 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the east.
- **#5** – 0.3 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the east.
- **#6** – 0.2 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the northeast.
- **#7** – 1,500 feet north of 221st Avenue on the bike trail looking to the east.
- **#8** – 750 feet north of 221st Avenue on the bike trail looking to the east.

### 6.5.2 Methodology

The process of analyzing visual impacts involved the following steps:

- Taking photographs from the designated locations using a 4.1 megapixel digital camera mounted on a tripod set a eye level (5’-6” above ground surface).
- Recording visual landmarks for later reference in superimposing the SDA image in the photographs.
- Creating 3D digital terrain models of the following three surfaces using AutoCAD software: existing topography, 75-percent developed SDA, and post-closure SDA.
- Determining sight-lines from the camera location to the SDA, with reference to landmarks and existing topographic features (e.g. berms, power poles, wind turbine).
- In AutoCAD, setting the proper camera and target locations and elevations, and rotating/zooming the 3D terrain models to the correct perspective.
- Determining the visible portion of the SDA by tracing site lines onto the 3D terrain model.
- Extracting the visible SDA from AutoCAD in wire-frames.
- Superimposing and rendering the wire frames in the photographs using Photoshop software.
- Checking for proper alignment of visual references.
- Superimposing screening devices on the rendered wire frames.

Photographs were taken on June 23, 2005. The weather was dry, sunny, and calm.
6.5.3 Mitigation Alternatives

The region surrounding the Landfill has rolling terrain and wooded areas, and some berming already in place around the adjacent aggregate mining operation. From some vantage points, these features effectively screened the SDA from view without additional mitigation. Mitigation screening was analyzed using berming and trees for other vantage points from which the SDA would be clearly visible. Currently, a combination of an earthen berm along with a mixture of pine and hardwood trees is being employed to provide screening. Evergreen trees provide year-round screening and appear to be the best choice.

Fencing was determined to have a lesser screening benefit than trees, depending upon the proximity of the vantage point to the fence, due to the limited feasible fence height (8 feet). Fencing can provide effective screening for close-proximity, eye-level vantage points and is a viable option, but is not included in the photographic renderings.

ERL is required by the City of Elk River permit to provide mitigation measures to screen the Landfill from viewers along Highway 169. An earthen berm currently exists surrounding the mining operation where the SDA would be developed. Use of this berm along with a mixture of trees is anticipated to be the method of choice for continued screening mitigation.

The berm is not contiguous surrounding the proposed SDA, however. Construction of a new berm to compliment the existing berm is anticipated across existing haul roads and other portions of the site. The cost to construct a berm is estimated to be $3.50 per cubic yard (includes top soil and turf establishment). A 10-foot high berm with 3H:1V sideslopes and a 6-foot top width has a cross-sectional area of 360 square feet (40 square yards). The volume of soil required to build a berm 1,500 feet (500 yards) long is 540,000 cubic feet (20,000 cubic yards). The total cost to build a berm of that length would be $700,000.

It is estimated that approximately 4,000 feet of berm would require the planting of trees to aid in screening mitigation. Assuming a density of one tree planted every 15 feet, approximately 270 trees would be required to provide screening. If each tree costs $150, the total cost for this screening option is $40,500. Watering and other maintenance would be required for the first two years.

6.5.4 Visual Impact Analysis

Five figures are presented for each of the 8 vantage points. The un-rendered original photograph is presented as the No-Built Alternative. The 75 percent developed and post-closure scenarios are each presented with and without additional screening. A cross-sectional schematic is presented with each figure to illustrate the camera location, existing landscape features and topography, proposed SDA topography at the specified development phase, and a sight line for reference to landmark features.
In some cases, the proposed SDA would not be visible due to existing landscape features such as trees/brush or existing berms. Should these features be removed in the future, the SDA may become visible from that location. Existing conditions accurately reflect the viewshed should the No-Build Alternative be selected.

6.5.4.1 Location #1

Location #1 is 0.9 miles south of the intersection of Highway 169 and 221st Avenue from the northbound lane of Highway 169 looking to the north. The existing Landfill and mining operations are visible as bare soil directly behind the yellow sign in the middle of the picture in Figure 19. Both the 75 percent developed and post-closure development phases will be visible from this location as depicted in Figures 20 and 21. Screening options were not analyzed for this location because the distance from the SDA and the elevation of the vantage point result in the screening options not providing a visible effect.

6.5.4.2 Location #2

Location #2 is at the intersection of Highway 169 and 221st Avenue from Highway 169 looking to the northwest. An earthen berm surrounding the current mining operation is visible in the foreground of the images from this location. A mixture of evergreen and hardwood trees have been planted intermittently along the crest of the berm. It is assumed that this berm and trees will not be removed during landfill construction and will be incorporated into screening mitigation. A chain link fence also surrounds the property. However, the fence does not affect the line of sight or add any screening value.

Figure 22 depicts the view from Location #2 should the no build alternative be selected. The existing Landfill is not visible in the picture. Figure 23 depicts the view from Location #2 of the 75 percent developed SDA. The SDA is visible over the top of the berm from approximately the center of the photo toward the right background. Figure 24 includes the addition of evergreen trees to provide further screening of the SDA.

The SDA at post-closure is more prominent from this location as shown in Figure 25. Evergreen trees and hardwood trees were added to Figure 26 to depict additional screening methods. The evergreen trees are approximately 20 feet high and the hardwood trees are approximately 30 feet high in the foreground of the photo.

This location is the site of a possible future interchange to be constructed in 2010 by the Minnesota Department of Transportation (MnDOT). Since MnDOT has not finalized design details of the interchange (elevation, lane widths, span length, barriers, etc.), it was not feasible to assume an elevation or line of sight from the top of the future interchange.
6.5.4.3 Location #3

Location #3 is 0.3 miles north of the intersection of Highway 169 and 221st Avenue from the northbound lane of Highway 169 looking to the northwest. Existing trees and foliage from this viewpoint almost completely block the view of the Landfill (Figure 27). These trees are outside of the limits of construction as presented in the Request for Permit Modification. The peak elevation of the SDA can be seen slightly at approximately the half-way point between the ground surface and top of the trees (Figures 28 and 29). If these trees were to be removed, the proposed expansion would be visible from the highway. No additional screening analysis was performed for this vantage point.

6.5.4.4 Location #4

Location #4 is 0.9 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the east (Figure 30). The existing Landfill is not visible from this location. The 75 percent developed SDA is slightly visible to the view and is located just to the left of the large pine tree on the left side of the photo (Figure 31). The top portion of the expansion at post closure will be visible from this vantage point above the existing trees (Figure 32). Screening options were not analyzed for this location because the distance from the SDA and the elevation of the vantage point result in the screening options not providing a visible effect.

6.5.4.5 Location #5

Location #5 is 0.3 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the east. An existing earthen berm, chain link fence, and mature trees parallel 221st Avenue on the north side at this location. Existing aggregate stockpiles are visible as shown on Figure 33.

The existing berm and trees would aid in screening the SDA at this location, however they are expected to be removed as part of the SDA development because they are beyond the 50-foot setback from the south property line. The MPCA municipal solid waste rules require a 200-foot set back from the fill area to the property line unless otherwise approved by the commissioner.

Figure 34 depicts the view of the 75 percent developed SDA. The predominant feature in this view is the perimeter berm that will be built as part of SDA construction. The developed cells at this stage are not visible to the east. SDA operations are located off the page to the north (left). Figure 35 incorporates a mix of evergreen and hardwood trees as visual impact mitigation.

Figure 36 depicts the SDA at post-closure. The SDA is readily apparent from this vantage point. Figure 37 incorporates a mix of evergreen and hardwood trees as visual impact mitigation.
6.5.4.6 Location #6
Location #6 is 0.2 miles west of the intersection of Highway 169 and 221st Avenue from the eastbound lane of 221st Avenue looking to the northeast. The view to the northeast from this location is blocked by an existing earthen berm and aggregate stockpiles as shown in Figure 38.

The perimeter berm to be built as part of SDA development is shown in the 75 percent developed Figure 39, however the landfill operations are not shown. Screening mitigation using a mixture of evergreen and hardwood trees at the property boundary is presented in Figure 40.

Figure 41 depicts the landfill visible at this location at post-closure. Figure 42 depicts screening mitigation using a mixture of evergreen and hardwood trees at the property boundary.

6.5.4.7 Location #7
Location #7 is 1,500 feet north of 221st Avenue on the bike trail looking to the east. Dense vegetation along the bike trail effectively screens the SDA from view of users. Views of the No-Build Alternative, 75 percent developed SDA, and post-closure are effectively the same. These trees are within the 200’ setback requirement along this side of the property and should not be removed for construction of the SDA. If these trees are removed, the SDA will be visible from this location. Figures 43-45 represent the view from Location #7.

6.5.4.8 Location #8
Location #8 is 750 feet north of 221st Avenue on the bike trail looking to the east. Dense vegetation along the bike trail effectively screens the SDA from view of users. Views of the No-Build Alternative, 75 percent developed SDA, and post-closure are effectively the same. These trees are within the 200’ setback requirement along this side of the property and should not be removed for construction of the SDA. If these trees are removed, the SDA will be visible from this location. Figures 46-48 represent the view from Location #8.

6.6 Compatibility with Land Use
This section summarizes local, regional, state, and federal use plans and regulations that affect the SDA. This section includes an analysis of the compatibility of the project with current and proposed, known long-term surrounding land uses. Potential conflicts with surrounding recreational, commercial, and residential uses located within one-quarter of a mile from the boundaries of the SDA are also identified.
6.6.1 Applicable Solid Waste Management Plans

6.6.1.1 City of Elk River Solid Waste Management Plan

The City of Elk River has a number of regulations pertaining to solid waste facilities to ensure their compatibility with, and minimize their impact on, surrounding uses, the environment, and other areas of potential concern. Chapter 58 of the City’s Code specifically regulates solid waste. This chapter addresses, among other things, the location, licensing, standards and operations of solid waste facilities. Additionally, the Zoning Code (Chapter 30) establishes a Landfill Overlay district as well as performance standards for uses generally, which would apply to any solid waste facility.

Chapter 58 would require the proposed landfill expansion obtain a solid waste facility license and follow certain standards. The City may only grant a solid waste facility license if it determines, among other things, that the facility “will be so situated, equipped, operated, and maintained as to minimize, to the maximum extent possible, using the best available technology, any potentially adverse impacts on:

a. The environment.
b. Groundwater quality.
c. Persons residing or working in the area.
d. Other land uses and activities in the area.
e. The use, enjoyment or value of any neighboring property.
f. The public health, safety, and general welfare.

The licensing process also allows for the City to apply additional standards to any given facility that may be necessary. It further provides for inspection of solid waste facilities to ensure their compliance with applicable regulations.

Chapter 30 limits the location of any solid waste facility to a Solid Waste Facility overlay zoning district. This district allows for solid waste facilities as conditional uses. As part of this landfill expansion project, a rezoning to Solid Waste Facility overlay district and a conditional use permit will be required for the SDA. The City may only issue a conditional use permit if it finds the use:

(1) “Will not endanger, injure or detrimentally affect the use and enjoyment of other property in the immediate vicinity or the public health, safety, morals, comfort, convenience or general welfare of the neighborhood or the city.
(2) Will be consistent with the comprehensive plan.
(3) Will not impede the normal and orderly development and improvement of surrounding vacant property.
(4) Will be served adequately by and will not adversely affect essential public facilities and services including streets, police and fire protection, drainage, refuse disposal, water and sewer systems, parks and schools; and will not, in particular, create traffic congestion or interference with traffic on adjacent and neighboring public thoroughfares.
(5) Will not involve uses, activities, processes, materials, equipment and conditions of operation that will be detrimental to any persons or property because of excessive traffic, noise, smoke, fumes, glare, odors, dust or vibrations.
(6) Will not result in the destruction, loss or damage of a natural, scenic or historic feature of major importance.
(7) Will fully comply with all other requirements of this Code, including any applicable requirements and standards for the issuance of a license or permit to establish and operate the proposed use in the city.”

Further, the City may impose specific requirements as necessary to ensure the use satisfies the standards above, and to ensure compatibility with and minimize adverse effects on adjacent uses, the neighborhood or the city. Specifically, these “may include, without limitation, requirements relating to the following:

(1) Ingress and egress to the property and proposed structures with particular reference to vehicle and pedestrian safety and convenience, traffic flow and control and access in case of fire or other catastrophe.
(2) Off-street parking and loading areas where required and the economic, noise, glare or odor effects of the proposed use on nearby property.
(3) Refuse and service areas.
(4) Utilities with reference to location, availability and compatibility.
(5) Diking, fencing, screening, landscaping or other facilities to protect adjacent or nearby property.
(6) Signs, if any, and proposed exterior lighting with reference to glare, traffic safety, economic effect and compatibility and harmony with properties in the district.
(7) Required yards and other open space.
(8) Design and location compatibility with adjacent properties and other properties in the district.
(9) Expiration date.

In addition to the requirements of the Solid Waste Facility overlay district and conditional use permit, the proposed landfill will be required to follow the standards of the underlying Agricultural Conservation district and other performance standards set forth in Chapter 30. In particular, the landfill will be required to be setback at least 50 feet from the property line. This will help buffer the use from adjacent properties, roadways and trails. The landfill use will also need to be screened from any residential district located within 50 feet.

The above regulations and standards will ensure compatibility of the proposed Landfill expansion and its end use with adjacent existing and proposed land uses.
6.6.1.2 Sherburne County Solid Waste Management Plan

Sherburne County has a number of regulations pertaining to solid waste facilities to ensure their compatibility with, and minimize their impact on, surrounding uses, the environment, and other areas of potential concern.

The County licenses and regulates all solid waste facilities through its solid waste ordinance. This ordinance addresses, among other things, the licensing, standards and operations of solid waste facilities. License agreements typically address issues beyond those included in the facility’s MPCA permit as necessary to “protect the public health, safety or the environment.” These often include a closure schedule, hours of operation, odor and litter abatement, and other site-specific issues.

The County also maintains a Solid Waste Management Plan. This plan is prepared by the Tri-County Solid Waste Management Commission, Sherburne County and the Office of Environmental Assistance. The Tri-County Solid Waste Management Commission includes Sherburne, Stearns and Benton Counties.

The proposed Landfill expansion is consistent with the Sherburne County Solid Waste Management Plan. The plan acknowledges the likely expansion of the Elk River Landfill, noting that it will be subject to Environmental Quality Board (EQB), MPCA, County, and City regulations. It also states that no new solid waste facilities are planned within Sherburne County at the time of its writing, and further, that existing facilities will expand as needed pursuant to State and County regulations.

6.6.2 Existing Zoning

The project property is currently zoned by the City of Elk River as Agricultural Conservation with a Mining Excavation district overlay, as shown on Figure 49. Gravel mining currently occurs on the property. The proposed Landfill expansion will begin upon completion of mining activities.

Figure 49 also shows lands within ¼ mile of the project site. Land immediately to the north, which includes the existing Elk River Landfill, is zoned Agricultural Conservation with Mining Excavation and Solid Waste Facility district overlays. As part of this Landfill expansion project, a request to expand the Solid Waste Facility overlay district to include the project site will be required.

Land to the east is zoned Agricultural Conservation with a Mining Excavation district overlay. Some areas to the southeast, as well as property to the west and northeast, are zoned Agricultural Conservation with no overlay.
6.6.3 Land Use

6.6.3.1 Existing Land Use

The City of Elk River’s Comprehensive Plan maps existing land uses as of 2002. The project property is identified as a combination of Mining and Open Space, as shown on Figure 50. According to the Scoping EAW prepared for the SDA project, USGS topographic maps for the site indicate that the site has been covered with brushland/woodland, with an open field in the southwestern portion of the property.

Figure 50 also shows existing lands within ¼ mile of the project property. Highway 169 runs along the eastern border of the property, while an abandoned railroad bed runs along the western edge, which is planned for a walking/biking trail in the future.

Land immediately to the north, which includes the current Elk River Landfill, is shown as a combination of Landfill and Open Space. Land immediately to the south is shown as Mining. Property to the east and west is primarily undeveloped, with a few Residential parcels to the southwest of the site. Further southwest is an area designated as Open Space. Another Open Space area lies to the northwest. There are additional, small, scattered Open Space areas to the northwest and southeast. Similarly, there are a few, small, scattered areas of Open Water within ¼ mile of the site. One Rural Business is located to the southeast.

Based on a review of the most recent aerial photograph (2003, Sherburne County), there appear to be 13 residences within ¼ mile of the project property, as shown on Figure 51.

Section 6.4 of this EIS includes a Visual Impact Analysis. This includes recommendations for berming, landscaping and setbacks to mitigate visual impacts of the SDA on adjacent land uses, including the planned trail, roadways and nearby existing and any potential future residential areas.

The proposed Landfill expansion is compatible with existing land uses in the project area, which are primarily undeveloped or industrial (i.e. mining, landfill) in nature. Mitigation measures such as setbacks, berming and landscaping will be employed to mitigate the visual impacts of the SDA on less intensive land uses, such as residential and recreational areas.

6.6.3.2 Future Land Use

The 2025 Future Land Use map contained in the City’s 2004 Comprehensive Plan indicates that the proposed future land use for the project property is Mining, as shown on Figure 52. As part of this Landfill expansion project, a request to expand the Landfill designation to include the project site will be required.

The Comprehensive Plan recognizes that mining operations will eventually cease and alternative future uses will need to be identified. Specifically, it states in reference to the
Mining designation, “An alternative use of this property is needed when the mineral resources are removed”.

The Plan does not delineate what those future, end uses should be, but it states, “It is important to note that the discussions at the Comprehensive Plan Task Force meetings as well as at other public meetings has been to guide the future development of this area toward a combination of Commercial and Industrial uses close to existing, and toward new roadway infrastructure and Residential uses adjacent to the park areas and the trail corridor.” The proposed landfill use is consistent with this proposal, given the site’s proximity to major roadway infrastructure. Although the Land Use Plan provides a separate category for “Landfill”, which was not part of the Comprehensive Plan Task Force’s proposal, such a use is generally industrial in nature.

Figure 52 also shows the planned, future land uses within ¼ mile of the project site. The area immediately to the north is guided for continued Landfill operations. Land immediately to the south is guided for Mining. Property to the east is guided for Commercial Reserve, while most of the land to the west is guided for Rural Residential use. A paved trail is planned for the abandoned railroad bed along the western edge of the property.

An end use plan has been prepared for the existing Landfill that includes the proposed expansion area. This plan provides for passive open space recreational uses of the majority of the site, with commercial opportunity at the intersection of Highway 169 and 221st Avenue. Long term, the proposed open space planned for the site would be compatible with any adjacent future residential development to the west, and actually provide an amenity for future residents. The end open space use includes integration into the planned trail system as well.

6.6.4 Trunk Highway (TH) 101/169 Corridor Management Plan

A Corridor Management Plan was prepared for the TH 101/169 Corridor in 2002. Prepared by the Minnesota Department of Transportation (MnDOT) in conjunction with corridor communities and other agencies, the plan identifies a number of improvements along the TH169 corridor to improve its overall safety and performance. Among these, is a proposed interchange at TH 169 and 221st Avenue in Elk River, which runs along southern boundary of the SDA.

The plan does not provide a schedule for planned improvements, but it does prioritize them in order of importance from A to D. As MnDOT programs projects and earmarks funds, projects with higher priority may receive greater attention. The TH 169/221st Avenue interchange is listed as a category "A" priority improvement. Category A improvements would need to be completed by 2010 to meet target performance goals.

The planned interchange has the potential to impact the area proposed for the Landfill expansion. Detailed design for the interchange has not yet been completed, but Figure 53 illustrates two hypothetical interchange configurations obtained from the MnDOT.
District 3 staff. The hypothetical interchange design displayed in red represents a “worse case scenario” in that it illustrates the maximum amount of right-of-way needed for a standard diamond interchange. Under this scenario, approximately 16 acres, or nearly 22 percent of the total SDA, would be consumed by the interchange. Any required setbacks would further increase the area potentially impacted. It is important to note that Figure 53 is based on the least compact design that might be implemented; therefore the actual area could be smaller.

The hypothetical interchange displayed in green on Figure 53 was obtained by ERL through a representative of MnDOT District 3 in 2002. ERL meet with MnDOT staff at that time to preserve an adequate amount of space to accommodate construction of the future interchange as part of planning for the SDA.

Once MnDOT prepares final design which identifies the exact right-of-way needed, they can work with ERL to identify appropriate mitigation measures and acquisition boundaries. However, the further the landfilling activities advance into the southern portion of the site, the more difficult it will be to avoid MnDOT’s preferred design. Therefore, the sooner the interchange design can be completed, the greater is the opportunity for preserving and/or acquiring the needed right-of-way. The design of the SDA can be modified to accommodate the MnDOT interchange.

Because the area impacted by the “worse case scenario design” comprises a very significant portion of the SDA, more compact designs should be considered. If more compact designs are not feasible, MnDOT and the ERL should study the feasibility of utilizing the space for landfill prior to roadway construction.

7 Economic and Social Impacts

7.1 Impacts on Disposal Costs

Disposal costs in the Region are market driven (beyond the impact of the state and local taxes covered in the next section). There does not appear to be a reason to expect disposal costs to change either up or down as a result of approval of the Landfill expansion. If the expansion does not occur and there is only one remaining landfill within the region that is permitted to accept MSW, there could be a risk of an increase in disposal rates due to the potential decrease in competition in the market place.

As noted in Section 5 there are other disposal facilities located outside the region that are capable of handling the wastes disposed at the Landfill. The projected costs to transport and dispose of the wastes at some of the alternatives compare favorably to the current costs at ERL. However, one of the key assumptions in the economic analysis in Section 5 is the availability of a transfer station capable of handling the average 375 tons per day currently managed by ERL. This transfer capacity is not currently available and therefore the risk to the region is still present.
7.2 Economic Impact

As noted in Section 5.4.4, for every ton of MSW disposed at ERL, a total of $11.00 is paid to public entities broken down as follows:

- City of Elk River  $3.33 landfill tax
- Sherburne County  $0.40 host fee
- Sherburne County  $0.60 landfill tax
- State of Minnesota  $6.67 landfill tax

Depending on the total tons of MSW and industrial wastes delivered to ERL, these taxes and fees amount to a significant source of revenue for the City, County, and State. Depending on where the wastes are disposed, all or a portion of these revenues could be lost for the public entities.

7.3 Social Impacts

7.3.1 Existing Recreational Resources

According to the City of Elk River’s map of existing and planned parks, trails, and open spaces, there is a linear park, known as The Great Northern Trail, adjacent to the SDA property. It is noted that this map, dated August 10, 2005, was accessed via the City’s website on August 25, 2005. This linear park, which includes a hiking/horse trail, is the only existing recreational resource within ¼ mile of the SDA. Existing trees along the western edge of the SDA property provide a visual buffer from the trail. These trees, or alternative visual buffers, should be maintained or established during land filling activities to mitigate potential visual impacts to trail users, to the extent practical. The Elk River Landfill End Use Master Plan provides for passive recreational uses and trails that would complement the existing linear park. The future trail system planned as an end use can be connected to The Great Northern Trail.

Rice Lake Park is located approximately 1/3 mile west of the SDA along 221st Street. The parks and trails map did not indicate any future park expansion areas associated with Rice Lake Park that extend toward the SDA property; therefore, the SDA would not impact plans for this existing recreational resource.

7.3.2 Planned Recreational Resources

An “Areawide/Conservancy Park” search area is located within ¼ mile of the SDA. This search area comprises approximately 4 square miles within which a future park is to be located. This search area is located east of TH 169 and does not include the SDA property.

An end use plan has been prepared for the existing Landfill that includes the proposed expansion area. This plan provides for passive open space recreational uses of the majority of the site, with commercial opportunity at the intersection of Highway 169 and
221st Avenue. Long term, the proposed open space and trail system planned for the site would complement existing and planned recreational resources.

Adverse impacts to existing or planned recreational resources from the Landfill expansion are not anticipated. With the addition of recreational resources proposed in the Elk River Landfill End Use Master Plan, a long-term beneficial impact to recreational opportunities for the citizens of Elk River and the surrounding communities is anticipated.
8 Mitigation Measures

The following sections identify measures that could reasonably eliminate or minimize adverse environmental, economic, employment, or sociological effects of the proposed expansion project. The mitigation measures are presented according to the sections of this document.

8.1 Alternatives Analysis

The findings of the alternative analysis indicate the preferred DALF is the Timberline Trail Recycling and Disposal Facility in Weyerhouser, Wisconsin, if the “No Build” alternative is selected. A “No Build” option, however, would place economic burdens on local and state government through the loss of revenue should the ERL expansion not be completed. Furthermore, the construction of a transfer facility in the region to transfer the estimated 375 tons per day from ERL to Wisconsin could potentially create additional impacts. Thus, if the “No Build” option is selected, additional studies and mitigation would be required that would otherwise not be needed if the ERL expansion is permitted.

8.2 Environmental Analysis

An environmental analysis was conducted for this EIS for potential impacts to groundwater, surface water, and air quality. The analysis indicates a minimal risk of contamination to groundwater as a result of the expansion.

Air quality and stormwater impacts require further analysis, which will be conducted as part of permitting. Potential impacts as a result of the project can be mitigated through Best Management Practices.

8.3 Economic and Social Impacts

Adverse economic impacts were identified to occur if the “No Build” alternative is selected. If the ERL expansion is not approved, economic impacts to users, and local, regional, and state governments could be significant. Mitigation would be to allow the expansion to proceed. No impacts to recreational facilities were identified; thus there are no mitigation measures recommended.
Appendix A
Figures
Appendix B
Bibliography
BIBLIOGRAPHY


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Appendix C
Definitions
Definitions

Ambient Pressure. “Ambient Pressure” means the surrounding pressure.

Aquifer. “Aquifer” means unconsolidated material or rock capable of producing water to supply a well.

Attenuation. “Attenuation” means a dilution, thinning, or weakening of a substance.

Bedrock. “Bedrock” means any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

Cap. “Cap” is a waterproof cover of soil, clay or plastic placed on a completed landfill lift after it has been completely filled, brought to final grade, and closed. Also called final cover.

Cell. “Cell” means compacted solid waste that is enclosed by cover material in a land disposal site.

Closure. “Closure” means actions to prevent or minimize the threat to public health and the environment posed by a closed facility including removing contaminated equipment, applying final cover, grading and seeding final cover, installing monitoring devices, constructing ground water and surface water diversion structures, and installing gas control systems, as necessary.

Closure Year. “Closure Year” means the year in which the landfill ceases, or is expected to cease, accepting waste.

Collection. “Collection” when referring to solid and hazardous waste, means the aggregation of solid or hazardous waste from the place where it is generated, and includes all activities up to the time the waste is delivered to a waste facility.

Compliance boundary. “Compliance boundary” means the planar surface that circumscribes the permitted waste boundary, lies between the permitted waste boundary and the property boundary, extends vertically downward from the land surface, and constitutes the place at which compliance with agency ground water quality standards is measured.

Concentric. “Concentric” means having a common center.

Control equipment. “Control equipment” means air pollution control equipment which eliminates, reduces or controls the issuance of air contaminants.

Contaminant. “Contaminant” means one that contaminates or makes impure or unclean by contact or mixture.
**Cover material.** “Cover material” means material approved by the agency that is used to cover compacted solid waste in a land disposal site. Important general characteristics of good cover material are low permeability, uniform texture, cohesiveness, and compactibility.

**Decomposition.** “Decomposition” refers to the breakdown of organic wastes by various means. Complete chemical oxidation leaves only carbon dioxide, water, and inorganic solids.

**Design capacity.** “Design capacity” means the total volume of compacted solid waste, topsoil, intermittent, intermediate, and final cover specified in the facility permit, as calculated from final contour and cross-sectional plan sheets that define the areal and vertical extent of the fill area.

**Dispersion.** “Dispersion” means the act or process of dispersing; to distribute (particles) evenly throughout a medium.

**Disposal.** “Disposal” or “dispose” means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any waste into or on any land or water so that the waste or any constituent thereof may enter the environment or be emitted into the air, or discharged into any waters, including groundwaters.

**Downgradient.** “Downgradient” means the direction that groundwater flows; similar to "downstream" for surface water.

**Emissions.** “Emissions” are odors or substances—usually gaseous or particulate—generated by the combustion of fuels and waste streams and discharged into the air.

**Facility.** “Facility” means the land, structures, monitoring devices, and other improvements on the land used for monitoring, treating, processing, storing, or disposing of solid waste, leachate, or residuals from solid waste processing.

**Fugitive emissions.** “Fugitive emissions” means pollutant discharges that could not reasonably pass through a stack, chimney, or other functionally equivalent opening.

**Generation.** “Generation” means the act or process of producing waste.

**Groundwater.** “Groundwater” means water contained below the surface of the earth in the saturated zone, including, without limitation, all waters whether under confined, unconfined, or perched conditions, in near-surface unconsolidated sediment or regolith, or in rock formations deeper underground.

**Heterogeneous.** “Heterogeneous” means completely different; incongruous.
**Hydraulic Gradient.** “Hydraulic Gradient” means in an aquifer, the rate of change of total head per unit of distance of flow at a given point and a given direction.

**HRL or Health Risk Limit:** A health risk limit (HRL) is the concentration of a groundwater contaminant, or a mixture of contaminants, that can be consumed daily with little or no risk to health and which has been promulgated under rule. A HRL is expressed as a concentration in micrograms per liter (ug/L).

**Industrial solid waste.** “Industrial solid waste” means all solid waste generated from an industrial or manufacturing process and solid waste generated from non-manufacturing activities such as service and commercial establishments. Industrial solid waste does not include office materials, restaurant and food preparation waste, discarded machinery, demolition debris, municipal solid waste combustor ash, or household refuse.

**Infiltration.** “Infiltration” means flow of water from the land surface into the subsurface.

**Intervention Limit.** “Intervention Limit” means an upper limit that, if exceeded, indicates the need for specified response actions.

**Landfill Capacity.** “Landfill capacity” is the amount of refuse that can be disposed of in the landfill.

**Landfill Gas.** “Landfill gas” is the product of biodegradation of refuse in landfills and consists primarily of methane and carbon dioxide with trace amounts of NMOC and air pollutants.

**Leachate.** “Leachate” means liquid that has percolated through solid waste and has extracted, dissolved, or suspended materials from it.

**Liner.** “Liner” means a continuous layer of reworked natural soil or synthetic materials beneath and on the sides of a land disposal facility, compost facility, or storage area that restricts the downward or lateral escape of solid waste, leachate, or gas.

**Methane Generation Rate Constant (k).** “Methane Generation Rate Constant (k)” is a constant that determines the rate of landfill gas generation. The first-order decomposition model assumes the k values before and after peak landfill gas generation are the same. k is a function of moisture content in the landfill refuse, availability of nutrients for methanogens, pH, and temperature.

**Methanogenic.** “Methanogenic” refers to the process of degrading hydrocarbons with the end product being methane (CH₄) gas and carbon dioxide.
Mixed municipal solid waste (MSW) land disposal facility. “Mixed municipal solid waste land disposal facility” means a site used for the disposal of mixed municipal solid waste in or on the land.

Monitoring point. “Monitoring point” means any installation or location used to determine the quality or physical characteristics of groundwater, surface water, or water in the unsaturated zone.


Non-methanogenic organic compounds (NMOC). Nonmethane organic compounds are contained in discarded items such as household cleaning products, materials coated with or containing paints and adhesives, and other items. During the waste decomposition process, NMOC can be stripped from the waste by methane, carbon dioxide, and other gases and carried in landfill gas.

Permeability. “Permeability” refers to hydraulic conductivity or coefficient of permeability, not intrinsic permeability, and has the dimensions of distance per unit time. Permeability is the measure of the ability of a soil or rock medium to transmit groundwater flowing under a hydraulic gradient of one unit of change in head per unit change in length.

Permittee. “Permittee” refers to the party responsible for adhering to the regulations and rules outlined in the permit issued by the agency.

Permitted waste boundary. “Permitted waste boundary” means the perimeter or outer limit of the waste fill, leachate piping, and leachate holding and treatment areas at a solid waste land disposal facility, as specified in the permit for the facility issued by the agency.

Piezometer. “Piezometer” means a type of monitoring well or other device that is constructed for the purpose of measuring hydraulic head in groundwater.

Pollutant. “Pollutant” means any “sewage,” “industrial waste,” or “other wastes,” as defined in this chapter, discharged into a disposal system or to waters of the state.

Pollution of water, water pollution, pollute the water. “Pollution of water,” “water pollution,” or “pollute the water” mean: (a) the discharge of any pollutant into any waters of the state or the contamination of any waters of the state so as to create a nuisance or render such waters unclean, or noxious, or impure so as to be actually or potentially harmful or detrimental or injurious to public health, safety or welfare, to domestic, agricultural, commercial, industrial, recreational or other legitimate uses, or to
livestock, animals, birds, fish or other aquatic life; or (b) the alteration made or induced by human activity of the chemical, physical, biological, or radiological integrity of waters of the state.

**Porosity.** “Porosity” is a measure of the water-bearing capacity of subsurface rock. With respect to water movement, it is not just the total magnitude of porosity that is important, but the size of the voids and the extent to which they are interconnected, as the pores in a formation may be open, or interconnected, or closed and isolated. For example, clay may have a very high porosity with respect to potential water content, but it constitutes a poor medium as an aquifer because the pores are usually so small.

**Postclosure; postclosure care.** “Postclosure” or “postclosure care” mean actions taken for the care, maintenance, and monitoring of a facility after closure that will prevent, mitigate, or minimize the threat to public health and environment posed by the closed facility.

**Potential Methane Generation Capacity (Lo).** “Potential Methane Generation Capacity (Lo)” is a constant that represents the potential capacity of the landfill to generate methane (a primary constituent of landfill gas). Lo depends on the amount of cellulose in the refuse.

**Property boundary.** “Property boundary” means the line circumscribing parcels of land entirely enclosing the facility.

**Refuse.** “Refuse” means putrescible and nonputrescible solid waste, including garbage, rubbish, ashes, incinerator ash, incinerator residue, waste combustor ash, street cleanings, and market and industrial solid waste, and including municipal treatment wastes which do not contain free moisture.

**Refuse-derived fuel.** “Refuse-derived fuel.” Means the product resulting from techniques or processes used to prepare solid waste by shredding, sorting, or compacting for use as an energy source.

**Release.** “Release” means to free from something that binds, fastens, or holds back; let go.

**Saturated zone.** “Saturated zone” is that part of the earth’s crust in which all the voids, large and small, are ideally filled with water under pressure greater than atmospheric.
Solid waste. “Solid waste” means garbage, refuse, sludge from a water supply treatment plant or air contaminant treatment facility, and other discarded waste materials and sludges, in solid, semisolid, liquid, or contained gaseous form, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include hazardous waste; animal waste used as fertilizer; earthen fill, boulders, rock; sewage sludge; solid or dissolved material in domestic sewage or other common pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents or discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended, dissolved materials in irrigation return flows; or source, special nuclear, or by-product material as defined by The Atomic Energy Act of 1954, as amended.

Solid waste collection. “Solid waste collection” means the gathering of solid waste from public or private places.

Solid waste management facility. “Solid waste management facility” means a facility for the storage, collection, transportation, processing or reuse, conversion, or disposal of solid waste.

Solid waste transportation. “Solid waste transportation” means the conveying of solid waste from one place to another by means of vehicle, rail car, water vessel, conveyor, or other means.

Static water level. “Static water level” means the distance measured from the established ground surface to the water surface in a well neither being pumped, nor under the influence of pumping nor flowing under artesian pressure.

Surface water standard. “Surface Water Standard” means a legally established state regulation consisting of three parts: (1) designated uses, (2) criteria, and (3) antidegradation policy that relates to surface water.

Transfer facility. “Transfer facility” means a facility in which solid waste from collection vehicles is compacted or rearranged for subsequent transport. A transfer facility may be fixed or mobile.

Total Head. “Total head” means the pressure of a fluid owing to its elevation, usually expressed in feet of head or in pounds per square inch, since a measure of fluid pressure is the height of a fluid column above a given or known point.

Unconsolidated materials. “Unconsolidated materials” means geological materials that are not rock and includes alluvium, glacial drift, glacial outwash, and glacial till.

Unsaturated zone. “Unsaturated zone” is the zone between the land surface and the water table. It includes the capillary fringe. Generally, the water is under less than atmospheric pressure.
**Upgradient.** “Upgradient” means the direction from which groundwater flows; similar to "upstream" for surface water.


**Waste boundary.** “Waste boundary” means the perimeter around the area permitted for filling with waste at a disposal facility.

**Waste collection service.** “Waste collection service” means a public or private operation engaged in solid waste collection and transportation.

**Water monitoring system.** “Water monitoring system” means a system of monitoring points in the vicinity of a facility that is used to determine the quality or physical characteristics of groundwater, surface water, and water in the unsaturated zone.

**Waters of the state.** “Waters of the state” means all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, reservoirs, aquifers, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface or underground, natural or artificial, public or private, which are contained within, flow through, or border upon the state or any portion thereof.

**Water table.** “Water table” means the surface of the groundwater at which the pressure is atmospheric. Generally this is the top of the saturated zone.

**Water quality standard.** “Water Quality Standard” means a legally established state regulation consisting of three parts: (1) designated uses, (2) criteria, and (3) antidegradation policy.

**Well.** “Well” means an excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed if the excavation is intended for the location, diversion, artificial recharge, or acquisition of groundwater. “Well” includes monitoring wells, drive point wells, and dewatering wells. “Well” does not include:

1. an excavation by backhoe, or otherwise for temporary dewatering of groundwater for nonpotable use during construction, if the depth of the excavation is 25 feet or less;

2. an excavation made to obtain or prospect for oil, natural gas, minerals, or products of mining or quarrying;
(3) an excavation to insert media to repressure oil or natural gas bearing formations or to store petroleum, natural gas, or other products;

(4) an excavation for nonpotable use for wildfire suppression activities; or

(5) borings.

Well Screen. “Well Screen” means the intake section of a well. It allows water to flow into the well but stops sand from entering. It also supports the borehole to prevent its collapse. Where the aquifer is in unconsolidated formations, such as sand or gravel, install a well screen at the bottom of the casing. If the aquifer is in porous, consolidated rock (ex. cemented sandstone), no screen is needed.