Independent External Review of Crane Mountain Landfill

Crane Mountain Enhancement, Inc.

ADI Limited
Report: (85) 5668-1.1
Date: November 2005

This report was prepared by ADI Limited for the account of the Crane Mountain Enhancement, Inc., formerly known as the Fundy Future Environment and Benefits Council.

The material in it reflects ADI Limited's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ADI Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

TABLE OF CONTENTS

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

LIST OF FIGURES

ADI Quality System Checks			
Project No.:	5668 - 1.1	Date:	November 2, 2005
Issue Status:	Final	Revision No.:	1
Prepared By:	Tom O'Connell, M.Eng., P.Eng.		
Reviewed By:	Roland LeBlanc, P.Eng.		

1.0 INTRODUCTION

1.1 Background

ADI Limited was retained by the Crane Mountain Enhancement, Inc. formerly the Fundy Future Environment and Benefits Council (FFEBC), to complete an Independent External Review of the Crane Mountain Landfill. FFEBC is a community-based group from within the Host Community near the landfill. Their role is to act as an advisory council and monitor all aspects of the Crane Mountain Landfill. ADI's role is to act independently of the Fundy Region Solid Waste Commission (FRSWC) and provide FFEBC with an objective review of the design and operation of Crane Mountain Landfill.

1.2 Crane Mountain Landfill

Crane Mountain Landfill is an engineered sanitary landfill serving the City of Saint John and the surrounding communities of Grand Bay - Westfield, Rothesay, Quispamsis, Hampton and St. Martins, as well as the Local Service Districts of Hampton, Rothesay, Kingston, Greenwich, Westfield, Petersville, Clarendon, Musquash, Saint Martins and Simonds. The landfill site includes lined disposal cells complete with leachate collection systems, a Construction and Demolition debris disposal site and a composting facility. The landfill began operation in 1997. It operates under an Approval to Operate issued by the NB Department of Environment and Local Government.

1.3 Scope of Work

The FFEBC monitoring committee defined the scope of work in the request for proposals dated January 28th, 2005. The RFP identified seven project objectives for the landfill review. These provide the overall framework for the project, while the FFEBC specifications provide a detailed list of tasks to be completed in order to address each objective. The following lists the objectives.

Objectives of Review

2.1 *To ensure that the landfill is operating in compliance with its Approval to Operate, issued by the Department of the Environment and Local Government, Province of New Brunswick.*

2.2 *To ensure that the provincial Approval to Operate is sufficiently comprehensive to safeguard the well being of the host community.*

2.3 *To ensure that the landfill is operating in compliance with the provincial and federal Clean Environment, Clean Air, Clean Water and Health Acts and associated regulations, as well as any other laws affecting the operation of the landfill.*

2.4 *To ensure that both surface water and ground water emanating from the landfill are not being contaminated by the landfill and to ensure that systems are in place to prevent their future contamination.*

2.5 *To ensure that landfill gas is not contaminating the surrounding environment and to ensure that systems are in place to prevent future contamination.*

2.6 *To ensure that the domestic wells down gradient of the landfill are not being contaminated by the landfill and to ensure that systems are in place to prevent their future contamination.*

2.7 *To provide the basis for an ongoing monitoring/review program, facilitated by FFEBC.*

Specifications

The FFEBC Monitoring Committee further defined the scope of work in a detailed list of Specifications. These provide a thorough task list for the project. Completing each of these tasks, provides the basis for providing recommendations to FFEBC for possible improvements to the landfill operations and monitoring program. The following lists the various specifications which are sequentially addressed through the report.

Specification 3.1 Review of Approvals to Operate

- *Assessment of the Fundy Region Solid Waste Commission's compliance with Approvals to Operate*
- *Assessment of adequacy of the Approvals to Operate in providing protection for domestic wells and streams in "host community" down gradient of landfill.*

Specification 3.2 Review of Monitoring Wells Surrounding the Landfill

- *Adequacy of location, design, and number of onsite monitoring wells, given the hydrogeological characteristics of the site.*
- *Analytical database of monitoring well data.*
- *Adequacy of background data with respect to scope and variability.*
- *Identification of analytical anomalies with particular attention to leachate indicator parameters.*
- *Adequacy of sampling and testing: quality control, frequency, and scope.*
- *Adequacy of analysis of data from testing.*
- *Adequacy of emergency response plans relative to findings in onsite monitoring wells.*

Specification 3.3 Review of Handling and Control of Leachate

- *Effect of uncapped cells on leachate quantity and quality.*
- *Effect of raising height of cells on integrity of clay and synthetic liners.*
- *Adequacy of material used for cell-capping.*
- *Permeability/breakthrough time of clay liner, under field conditions, relative to recorded heights of leachate in cells (based on studies of three sources of materials tested).*
- *Effect on clay and synthetic liners of using cells as holding ponds.*
- *Pre-treatment of leachate before disposal.*
- *Assessment of interaction between groundwater and surface water.*
- *Surge pond: Integrity of clay liner and synthetic liner, using projected depth of stored leachate.*
- *Identification of chemical composition of leachate.*
- *Adequacy of sampling and analysis of sampling of under-drain layer.*
- *Adequacy of emergency response plans relative to leachate control.*

Specification 3.4 Review of Handling and Control of Onsite Surface Water

- *Effectiveness of sedimentation ponds in treating and containing surface runoff during normal conditions.*
- *Effectiveness of sedimentation ponds in treating and containing surface water during conditions of heavy or extended precipitation.*
- *Effectiveness of monitoring of surface water runoff.*

Specification 3.5 Review of Handling/Disposal of Hazardous Wastes

- *Methods of identification and control of industrial and household hazardous wastes.*

Specification 3.6 Review of Waste Diversion

- *Methods used.*
- *Rate of diversion.*

Specification 3.7 Review of Daily Operations

- *Daily cover.*
- *Quality control of acceptable and unacceptable waste.*
- *Pest and bird control.*

Specification 3.8 General Review of Monitoring/Control of Landfill Gas

- *Effect of uncapped cells on landfill gas production.*
- *Monitoring/control of concentration and migration of methane, carbon dioxide, non-methane organic compounds (NMOCs).*
- *Monitoring/control of lateral migration of landfill gas.*
- *Monitoring/control of airborne particulate and odour.*

This entire specification was deleted from the scope of work. Only a brief commentary will be presented relative to this item.

Specification 3.9 Review of Issues Related to Domestic Wells

- *Location of wells tested.*
- *Number of wells tested.*
- *Frequency of testing.*
- *Parameters tested.*
- *Adequacy of emergency response plans relative to domestic well contamination.*
- *Devise a system whereby results of domestic well tests can be managed.*

Based on the findings related to the review of each Specification, recommendations were developed. FFEBC suggested recommendations related to the following three areas:

Item 4.1 Highlighting of real and/or potential areas of concern, if any.
Item 4.2 Proposals for remedial measures, if required.
Item 4.3 Proposal for regular, ongoing monitoring/review of landfill.

1.4 Project Team and Acknowledgements

This review has been completed by ADI Limited. The personnel who contributed key components to the study included Tom O'Connell, M.Eng., P.Eng., John Sims, M.Sc., P.Eng., P.Geo., Bob Gallagher, M.Sc.Eng., P.Eng., Tim Murphy, M.Eng., P.Eng. and Chad Connors, P.Eng., with review by Roland LeBlanc, P.Eng. and Dave Crandall, M.Eng., P.Eng.

We wish to acknowledge the assistance of the FFEBC Monitoring Committee including Roberta Lee, Roger McKenzie, Danny Harrigan, David Bowen, Allen Titus and their consultant Sid Lodhi, P.Eng.

It is also noted Jack Keir and Ron Nelson of the FRSWC were very helpful in compiling and providing many relevant background documents.

2.0 CRANE MOUNTAIN LANDFILL

2.1 Location

The Crane Mountain Landfill is in the northwestern part of the City of Saint John and is located along Highway 7, adjacent to the Route 177 exit to Martinon and the Town of Grand Bay-Westfield. Grand Bay is approximately 5 km northeast of the landfill and Martinon is approximately 4 km northeast of the landfill. Other communities in the immediate area include Morna, Morna Heights, Belmont, Ketepec, Acamac and South Bay, all located along the Saint John River approximately 4 to 5 km east of the landfill. Figure 2-1 shows a location plan for the landfill.

Figure 2-2 is an aerial photo of the landfill looking northeast towards Martinon and Grand Bay.

2.2 Geological/ Hydrogeological Setting

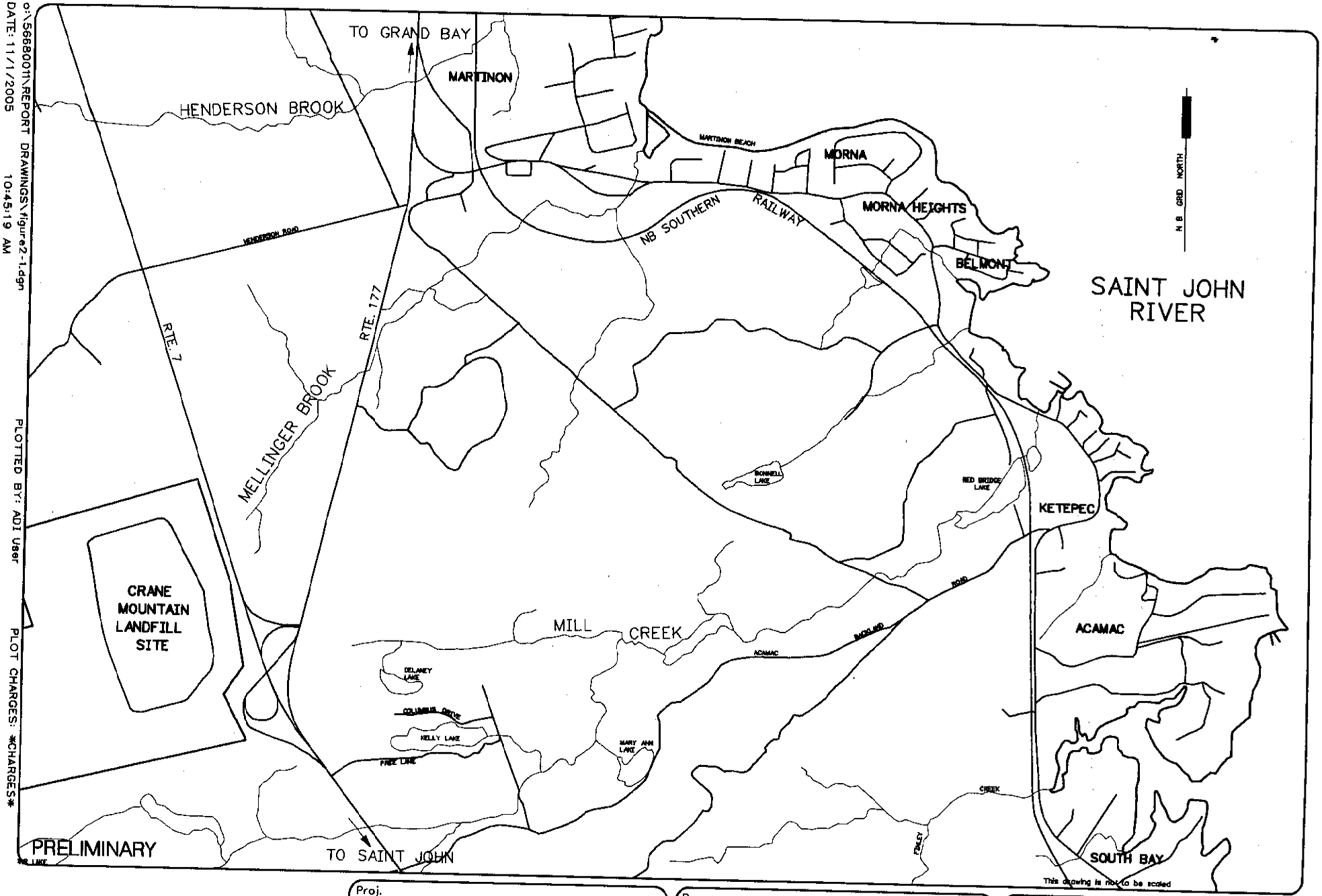
Background information regarding site setting has been provided in EIA documentation prepared for the site, and the related report (Gemtec, 1993) *"Selection of a Sanitary Landfill Site for the Fundy Region Detailed Site Investigation Crane Mountain (Gemtec Limited, File 20658.01, December 1993)"*. A summary of information follows.

Physiography, Topography and Drainage

The Cranc mountain site is located in the eastern part of the Musquash Lowlands, described as an undulating plain with isolated clusters of hills bordering the Bay of Fundy (Rampton, 1984). The Musquash Lowlands are a subdivision of the St. Croix Highlands.

The site is characterized by flat to gently rolling topography with elevations ranging from a low of elevation 62 to a high of elevation 100 m above sea level. Drainage is to the east towards Mellinger Brook. Topographic gradient of the general site area is in the range 4 to 12 %, with regional topographic gradient of approximately 3%.

The site is located approximately 4 km east of the Saint John River, and primarily within the drainage basin of Mellinger Brook that flows eastward and discharges into the Saint John River at Martinon Beach. This drainage basin is bounded to the west by Henderson Lake, and to the north by Henderson Brook (flows out of Henderson Lake). The southern edge



o:\5668001\REPORT DRAWINGS\figure2-1.dgn
DATE: 11/1/2005 10:45:19 AM
PLOTTED BY: ADI User
PLOT CHARGES: *CHARGES*

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.
INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg.
LOCATION PLAN

Drawn By: OSE	Proj. No. 5668-001.1	
Dwg Standards Chk. By:	Dwg. No. FIGURE 2-1	
Designed By: TKO	Dwg Design Ckd By:	Rev. 0

Aerial Photo of Crane Mountain Landfill Figure 2-2

of the site is near the drainage divide of Mill Creek. Carr Lake and Ghost Lake form the headwaters of Mill Creek which flows east and discharges into the Saint John River at Ketepec. In general, overall drainage for the site is to the east, where surface water would discharge to the Saint John River at Martinon Beach via Mellinger Brook that drains the small watershed in which the landfill is located.

Geology

Surficial Geology - Overburden geology consists generally of a thin root mat and layer of surface organics overlying glacial deposits. The glacial deposits are mapped regionally as a blanket of loamy lodgement till, minor ablation till, silt, sand, gravel and rubble varying in thickness from 0.3 to 3 m. (Till is defined as predominantly unsorted and unstratified drift, generally unconsolidated, deposited directly underneath a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, and boulders ranging widely in size and shape, *Groundwater and Wells, Johnson Filtration Systems Inc, 1986*). Results of test pits and boreholes completed as part of the site characterization process indicate in general 0.2 m to 0.5 m of organics and silt overlying a lodgement till. The till stratum generally includes a medium dense till observed to overlie a dense to very dense till, with till thickness ranging from 4.6 m to 14.0 m thick over the south half of the Crane Mountain site. In the north half of the site the thickness of the till drops to 1.2 m to 2.4 m in some areas.

The fine grained fraction (silt and clay) for the till was in the range 30.6 to 51.5 %, and averaged 37 % silt and clay (16 % as clay size), with the till classified as silty sand with low plasticity fines. Hydraulic conductivity of remolded till samples was typically on the order of (3×10^{-10} m/s). (Hydraulic conductivity is defined as the rate of flow of water through a unit cross-section under a unit hydraulic gradient. In the metric system, the units are $m^3/day/m^2$ or m/day (or m/s), *Groundwater and Wells, Johnson Filtration Systems Inc., 1986)*. This value is considered relatively low, although as noted in site characterization documentation (e.g. Gemtec, 1993), *"....field scale hydraulic conductivity is likely controlled by the presence of cracks or fissures within the till, and as such, may be considerably higher than that applicable to the remolded samples."* An average in situ hydraulic conductivity value of 2×10^{-7} m/s was cited based on three field tests.

Bedrock Geology - Regional bedrock geology in the area includes the Cambrian Age Milkish Head Pluton, with rock types including grey quartz diorite and tonalite gradational to pink granodiorite. Bedrock to the south of the site includes Ashburn Lake Formation

metasediments of Cambrain to Pre-Cambrian Age, comprised of marble, orthoquartzite, minor sandstone and marble-sandstone conglomerate.

Bedrock underlying the site is predominantly pink granite and greenish granodiorite/ granite with some mafic volcanic and/or metasediment (summarized in Figure 5.1, Gemtec, 1993). Hydraulic conductivity for three boreholes reported in the detailed site characterization report (Gemtec, 1993) were 2.4×10^{-6} m/s (BH16S), 8.6×10^{-7} m/s (BH17S), and 5.6×10^{-6} m/s (BH17D).

The EIA report noted bedrock to be fractured, with fracturing described variably as "highly fractured" to "numerous fractures". No major structural discontinuities were reported based on the EIA site characterization work. Additional information and comments on bedrock geology was provided in a review paper (Fracflow Consultant Inc., 1997) of the EIA. According to this review, bedrock at the site is highly fractured, with observation from outcrops suggesting at least three to four sets of fractures; one set essentially subhorizontal, and three subvertical in orientation.

Hydrogeology

Site Hydrogeology - The detailed site characterization report (Gemtec, 1993) described groundwater flow at the site as consisting of a shallow system in the loose and thin near surface soils perched above the less permeable, silty glacial till. Flow direction(s) in this system are governed by variations in the surface of the till which was reported to loosely resemble surface topography. The shallow bedrock groundwater flow system was interpreted to be generally east north east, generally coincident with topographic slope (see Figure 5.1, Gemtec, 1993). Downward gradients were generally observed indicating recharge conditions; this is expected given the location of the site in the upper reach of the drainage basin.

Comment on Hydrologic Setting - The landfill site is located in the upper reach (recharge area) of the Mellinger Brook watershed, and is within proximity to the upper reach of the Mill Creek watershed located south of the site. In general, groundwater recharges in upland areas and discharges at the lower reach of a drainage basin. Depending on various factors (e.g. relative size and topographic configuration of a drainage basin) shallow, intermediate, and deeper groundwater flow systems can be present within a given watershed. In general, the deeper groundwater flow system is characterized by recharge in the upper reach, flow to depth, and discharge at the lower reach of the drainage basin, with intermediate and

shallow flow systems superimposed on the deeper system depending on topography, geology, etc.

A general comment concerning site specific hydrogeological characterization provided in the detailed characterization report is the generally shallow depth of bedrock penetrated in bedrock boreholes and monitoring wells. Additional boreholes and monitoring wells have been installed as part of the groundwater monitoring system. It is recommended that the collective database be reviewed and documented in the context of an updated hydrogeological characterization report for the site. The review should include consideration of such factors as hydraulic conductivity; fracture distribution and frequency; flow gradients, directions, and velocities; groundwater chemistry; and consideration of site hydrologic setting in the context of shallow, intermediate and deeper flow systems.

Regarding the site being located in the recharge area of the drainage basin, it is acknowledged that in the context of potential impacts on the deeper flow system(s), the landfill liner hydraulic barrier is expected to provide a relatively high level of protection, in addition to the site specific natural mitigative attributes. Discounting the liner system underlying the waste material, site specific mitigating factors to assist in minimizing or eliminating the potential for groundwater impacts in the event of leakage include the presence of low permeability overburden deposits (glacial till) which are anticipated to result in a significant portion of incident waters to runoff by overland flow, or as a component of local shallow and or intermediate groundwater flow within the upper reach of the drainage basin. The dense to compact nature of the till and relatively high proportion of fines is also anticipated to provide additional natural protection to the underlying bedrock. However, as noted in the site characterization report work, preferential pathways can potentially be present through low permeability tills. Where present, such pathways can lower the natural protection typically provided by otherwise fine grained low permeability overburden.

2.3 Facilities

Operation of the Crane Mountain Landfill began in November 1997. The following summarizes the key components of the engineered landfill:

- Sedimentation ponds and treatment system (1997)
- Cell # 1 c/w leachate collection and extraction system (1997)
- Cell # 2 c/w leachate collection system connecting to Cell #1 (1998/99)
- Cell # 3 c/w leachate collection and extraction system (2002/03)

- Cell # 4 c/w leachate collection system connecting to Cell #3 (2004/05)
- Zenon leachate treatment system (decommissioned)
- Organic waste compost facility (2001)
- Construction and Demolition debris waste site (2002)
- Surge Pond (2004)
- Closure of the sideslopes of Cell #1 and Cell #2 (1999 & 2001)

For reference, the following is a list of the initial construction contracts issued during the construction of the landfill.

Tender 97-01	Site Clearing
Tender 97-02	Supply of Clay
Tender 97-03	Supply of Bentonite Amended Soil
Tender 97-04	Construction of Soil Liner Test Pads
Tender 97-05	Site Work - Phase 1
Tender 97-06	Site Work - Phase 2
Tender 97-07	Ancillary Buildings & Scale
Tender 97-08	Containment Cell #1
Tender 97-09	Site Work - Phase 3
Tender 97-10	Highway Interchange Upgrade
Tender 97-11	Office / Maintenance Buildings
Tender 97-12	Leachate Sewer
Tender 97-13	Off Site Landscaping & Visual Buffers
Tender 97-14	Commercial Laboratory Services
Tender 97-15	Leachate Pre-Treatment

A partial list of some of the subsequent larger expansions included the following.

Contract 98-07	Site Grading and Berms
Contract 98-08	Supply of Clay
Contract 98-09	Supply of Clear Stone
Contract 98-10	Containment Cell #2
Contract 98-11	Raising of North Berm @ Cell 1
Contract 98-12	Supply and Installation of Geosynthetics - Raising of North Berm
2000	Compost Facility (opened in July 2001)

Tender 00-01	Construction of Cover Lysimeters
Tender 00-02	Cell #3 - Lower Subdrains
Tender 00-11	Supply and Placement of Frost protection Material (Cell #3)
Contract 01-02	Containment Cell #3
Contract 01-03	Cell #3 Grading and Berms
Contract 01-04	Supply of Clear Stone
Contract 01-05	Cell #3 Pumps and Forcemain
Contract 01-06	Final Cap - Side Slope Cell #2 and Cell #1 Lysimeter
Contract 04-02	Leachate Surge Lagoon (Civil Package)
Contract 04-04	Leachate Surge Lagoon (Mechanical & Electrical Package)
Contract 2005-1	Containment Cell #4
Contract 2005-2	Supply of Clear Stone, (Cell #4)
Contract 2005-3	Supply of Clayey Material (Cell #4)

2.4 Operations

The Crane Mountain Landfill has several components and operations. These are shown in the overall landfill plan, Figure 2-3 at the back of the report.

The facilities at the landfill include the following:

- solid waste disposal cells
- leachate surge pond
- leachate collection system complete with three pump stations
- construction and demolition debris disposal site
- organic waste composting facility
- surface water sedimentation ponds

This review will focus on those facilities highlighted in FFEBC's objectives and specifications.

3.0 REVIEW OF APPROVALS TO OPERATE

3.1 Introduction

This chapter provides a Review of Approvals to Operate as per Specification 3.1 of FFEBC's Terms of Reference, which included the following:

- *Assessment of the Fundy Region Solid Waste Commission's compliance with Approvals to Operate*

- *Assessment of adequacy of the Approvals to Operate in providing protection for domestic wells and streams in "host community" down gradient of landfill.*

3.2 Background

The Fundy Region Solid Waste Commission currently operates the Crane Mountain Sanitary Landfill under Approval to Operate number SL6-R, a copy of which is included in Appendix A. The current Approval is valid from January 1, 2004 through to December 31, 2006. The Approval to Operate is issued to the :

Fundy Region Solid Waste Commission
for the operation of the
Crane Mountain Sanitary Landfill

with the description of the facility as follows:

A Regional Sanitary Landfill (and Construction and Demolition Debris Disposal Site) handling municipal solid waste (MSW) in Saint John and the western portion of Kings and Queens Counties of New Brunswick.

The Approval is issued in accordance with the Clean Air Act, Clean Water Act and the Clean Environment Act.

There have been a series of Approvals to Operate since the construction of the landfill. These are summarized in the following table, with the key changes noted.

Summary of Approvals to Operate

Number	Valid From	Valid To	Notes
SL6-C97	3 June 1997	Dec. 31, 1998	Approval to Construct
SL6-R97	Nov. 10, 1997	Dec. 31, 1998	First Approval to Operate
SL6-R99	Dec. 31, 1998	Dec. 31, 1999	
SL6-R2000	Jan. 1, 2000	Dec. 31, 2001	
SL6-R2002	Jan. 1, 2002	Dec. 31, 2003	
Amendment	Jan. 30, 2002		Construction and Demolition Facility added.
Amendment	Mar. 15, 2002		Revisions to permeate discharge monitoring.
SL6-R1	Jan. 1, 2004	Dec. 31, 2006	

The operations at the landfill will be reviewed relative to the conditions of the Approval. This includes the landfill design, operations and monitoring program.

3.3 Compliance with Approval to Operate

Generalized comments on the compliance of the landfill design and operations are presented in this section, but the detailed assessment of key aspects of the Approval to Operate are addressed throughout the report.

Design of Landfill

Based on the information available for this review, the design of each landfill cell appears to meet the requirements of the Approval. This includes the HDPE and clay liner system, and associated leachate collection components. The leachate collection system is reviewed in further detail in Chapter 5.

Monitoring Program

In general, the detailed monitoring program defined in the Approval appears to have been followed by the FRSWC. Chapter 4 provides a full review of the monitoring program associated with the wells surrounding the landfill. Underdrain monitoring is covered in

Chapter 5, while surface water monitoring is reviewed in Chapter 6. Chapter 11 addresses the domestic well monitoring program.

Reporting

The Approval to Operate defines very specific reporting requirements. These reports and their status relative to the FRSWC are summarized below in relation to the Item number in the Approval.

Item 32. Every five years review assumptions associated with post-closure costs. Ongoing.

Item 33. Record monthly Waste Inventory. This is done.

Item 50. Prior to August 27, 2004, conduct video inspection of the leachate collection piping. See Item 105.

Item 63. Provide Asbestos Disposal Records for all asbestos. This is done.

Item 79. Record all monitoring data. This is done.

Item 91. Prior to August 4, 2006, conduct a Monitoring Program Review by an independent third party. Pending.

Item 92. Record leachate levels in the sumps on each week day. This is done.

Item 95. Have a Contingency Plan for leachate disposal. This is done.

Item 101. Submit a plan for Cell #4 Tier 1 and Tier 2 monitoring wells. In a Gemtec letter dated August 17, 2005 a plan was presented to install one new monitoring well by the Surge Pond. It was proposed that the new well in conjunction with two existing wells downstream of Cell #3 would meet the monitoring requirements for Cell #4. In an email from the NBDOELG dated September 1, 2005, the concept was approved.

Item 102. Prior to January 31, 2004 submit a Site Map and Report complete with a flowchart for the facility. Landfill site plans exist, but an up-to-date detailed

report outlining the landfills operations and sequence of development appears to be lacking.

Item 103. Prior to April 30, 2004 submit a Contingency Plan to manage permeate (leachate effluent). This plan, although brief, provided a clear strategy for trucking all leachate to the Lancaster treatment plant.

Item 104. Prior to April 30, 2004 submit a copy of the Emergency Response Plan. The plan has been in place since 1997, with an update in August 2000.

Item 105. Prior to August 27, 2004 submit an inspection report of the leachate collection piping. Video inspections were not completed, but alternative methods were employed to test the collection pipes flow capacity. Reports were submitted as required.

Item 106. Prior to August 27, 2004 submit an interim leachate management plan for handling additional leachate from Cell # 4. The documentation and facilities related to this item included the construction of the Surge Pond and a plan for using it to handle leachate in excess of trucking capacity.

Item 107. Prior to August 4, 2006 submit a copy of the Monitoring Program Review, as described in Item 91. Pending.

Item 108. Prior to November 30 of each year submit a Domestic Well Monitoring Program report. This report has been submitted each year to the Department of Health and Wellness. Chapter 11 provides a review related to this item.

Item 109. Prior to November 30 of each year submit a copy to each homeowner the results of their domestic well monitoring. This is done.

Item 110. Within 30 days of the end of each Quarter submit a copy of all the monitoring analyses. This report has been submitted each Quarter. The groundwater monitoring program and analyses are reviewed in Chapter 4.

Item 111. By March 31 of each year submit an annual report with all the monitoring information. This report has been submitted each year. The specific analysis of the data is review in Chapters 4, 5, 6 and 11.

Overall it seems that the FRSWC has met the reporting requirements of the Approval, but as noted in later chapters there are some aspects of the reporting that could be improved.

Construction and Demolition Site

The Construction and Demolition (C&D) disposal site received approval January 2002. An amendment was issued to the existing Approval to Operate for the construction and operation of the site. Some of the key requirements included the following:

- Meet the Guidelines for the Siting and Operation of a Construction and Demolition Site.
- Ensure 1.5 m of overburden (natural or imported) under the C&D site.
- Divert surface water away from the site.
- Provide a minimum of three monitoring wells, with one being up-gradient.
- Clearly defined acceptable and unacceptable materials.
- Monitor all waste disposed of at the site.
- Provide 150 mm of cover on a weekly basis.

These basic requirements appear to be met at the landfill.

Operations

Various aspects of the operation of the landfill are specified in the Approval to Operate. These range from daily cover requirements to litter control and drainage ditch maintenance. Some items are not presently in compliance, and either require an amendment to the Approval, or updates at the landfill. These include the leachate disposal system, with all leachate untreated and trucked to the Lancaster treatment plant. These items are discussed further in Chapter 5. In addition, the lack of an air quality sampling station during construction activities is inconsistent with Item 69 of the Approval.

Besides the items noted, in general it appears that the landfill is operating in compliance with most of the Approval requirements and that the design of the landfill is in compliance with the Approval.

3.4 Adequacy of Approval to Operate

The adequacy of the Approval to Operate relates to the ability of the landfill systems to protect the domestic wells and streams in the "host community" down gradient of the landfill. To fully answer this question, the review of the landfill systems is first required. Therefore, the findings of this study, presented in Chapter 12, will address this issue.

4.0 REVIEW OF MONITORING WELLS SURROUNDING THE LANDFILL

4.1 Introduction

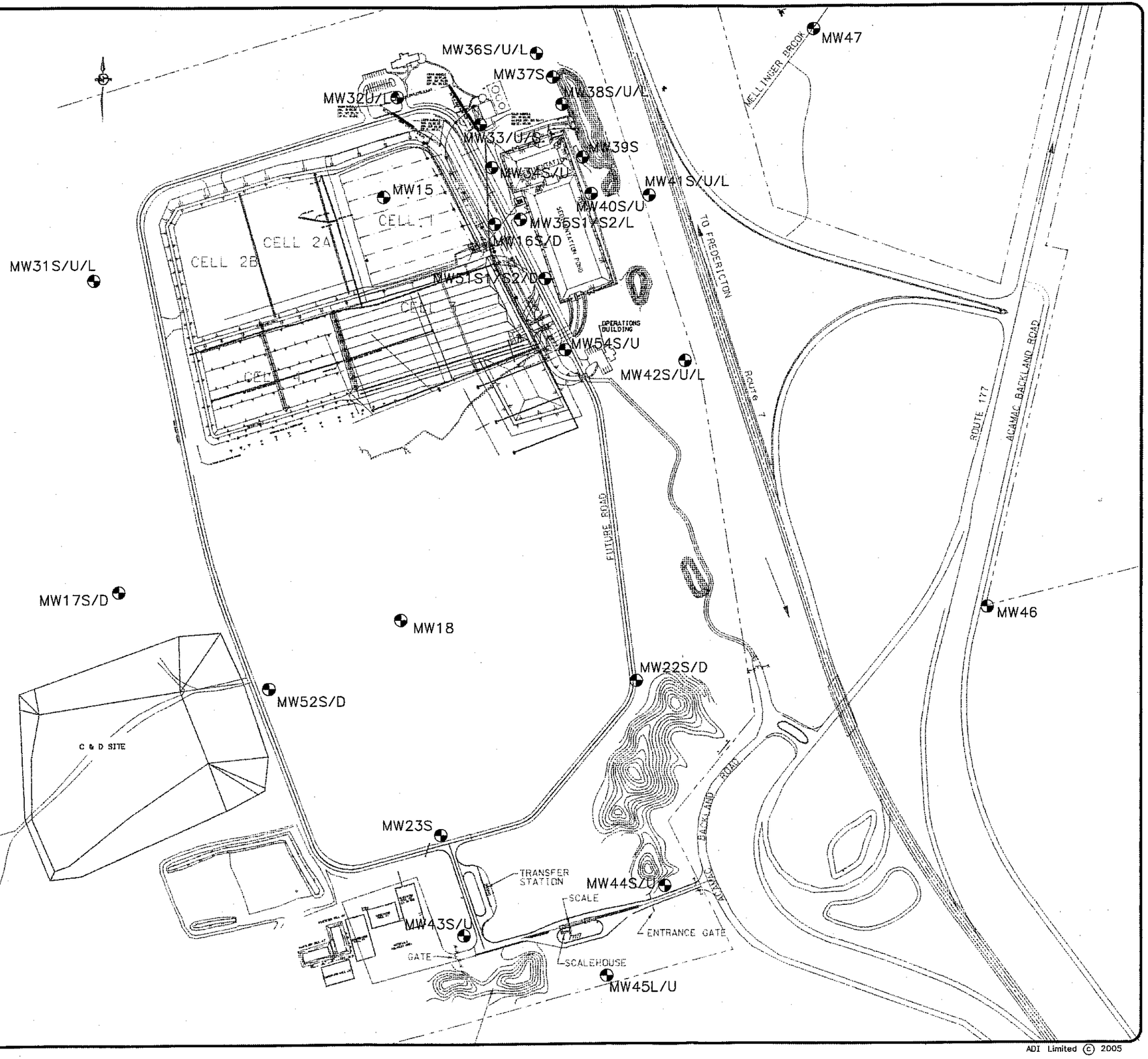
The Crane Mountain Landfill is surrounded by over 50 monitoring wells. Samples from the monitoring wells are analyzed to check for any impacts of the landfill on the quality of the surrounding groundwater. This chapter provides a Review of Monitoring Wells Surrounding the Landfill as per Specification 3.2, which includes the following:

- *Adequacy of location, design, and number of onsite monitoring wells, given the hydrogeological characteristics of the site.*
- *Analytical database of monitoring well data.*
- *Adequacy of background data with respect to scope and variability.*
- *Identification of analytical anomalies with particular attention to leachate indicator parameters.*
- *Adequacy of sampling and testing: quality control, frequency, and scope.*
- *Adequacy of analysis of data from testing.*
- *Adequacy of emergency response plans relative to findings in onsite monitoring wells.*

4.2 Adequacy of On-site Monitoring Wells

The existing groundwater monitoring network is comprised of over fifty groundwater monitoring wells installed at approximately twenty discrete locations. Most of the wells included in the existing well network were installed during the fall of 1997 (50 wells installed), and results of this work were summarized in the report entitles *"Monitoring Well Installation Program Crane Mountain Regional Sanitary Landfill Saint John, New Brunswick", (Gemtec Limited, file: 658.17, April 1998).* Subsequent to completion of this main network of wells, based on documentation provided six additional wells (51D, 51S1, 51S2, 52S, 52D, and 53D) at three new locations were established during 2002 to monitor the construction and demolition debris disposal cell area. Results of this work were provided in a letter report to the Commission dated April 23, 2002 (*Gemtec file: 658.52).* Figure 4-1 shows the location of the monitoring wells.

Regarding the main monitoring system installed in 1997, the network includes two angled boreholes (MW37A and MW39A) which were outfitted with multi-level groundwater monitoring installations. It is understood that the original monitoring network was designed



ADI Limited © 2005

No.	Revision	Ckd. By	Date

PRELIMINARY

Const. North

Drawn By:

Dwg. Standards Ckd. By:

Designed By:

Date Printed

Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Project Title

INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. Title

MONITORING WELL LOCATIONS

Project No.	5668-001.1
Dwg. No.	FIGURE 4-1
Rev. No.	0
Scale	1:5000

This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney Port Hawkesbury, St.John's, Fredericton and Salem, NE

in a tiered manner. Tier 1 wells (MW32 through MW40) were installed closest to the area of original cell construction and the site sedimentation ponds. The Tier 1 wells are generally within 20 to 30 m of the larger potential source areas (e.g. landfill cells, pond(s)). Tier 2 wells (MW41 through MW47) were established further to the east of the original cell area (generally within the range of 100 to 200 m from the landfill cell area), and south of the Tier 1 wells adjacent to the area of future cell development. Finally, the Tier 3 wells (MW48, MW49 and MW50) were established at relatively remote (e.g. > 1km) locations relative to the landfill, with these wells intended to serve as "long range" monitoring locations. These off-site wells are shown on Figure 6-3. Most wells were installed with a geo-environmental type drilling rig, but a few wells were installed with an air rotary drilling rig.

As discussed in **section 2.2** site stratigraphy includes a variable depth of overburden sediments (mainly glacial till) overlying fractured bedrock. Typically, monitoring well networks for solid waste disposal sites should include nested wells to monitor each distinct hydrostratigraphic unit (e.g. overburden deposits, shallow bedrock, "intermediate" bedrock, and "deeper" bedrock). The Crane Mountain monitoring network has generally been completed in this manner. Based on a review of the background information provided related to the site groundwater monitoring network, it appears that the existing network is similar to those installed at other regional landfill facilities in the province, and is considered adequate with respect to location, design and number of on-site monitoring wells given the hydrogeological characteristics of the site.

It is recommended that further characterization of the hydrogeological system be made as it relates to flow pathways within the bedrock and geochemical evolution of groundwater in the context of water supply usage by downgradient domestic wells.

4.3 Analytical Database of Monitoring Data

The Fall, 1997 baseline monitoring data and the most recent monitoring results for the Fall, 2004 monitoring round were reviewed. For this review, the groundwater monitoring data were compared with the Guidelines for the Protection of Canadian Drinking Water Quality (GPCDWQ) established by Health Canada. Related discussion on analytical anomalies is provided in **section 4.5**.

Regarding groundwater quality, concentrations of iron and manganese in excess of their respective guideline values were observed at many monitoring locations. However, it is

noted that the guideline values for these parameters have been established on the basis of aesthetic considerations such as the control of staining and encrustation of pipeworks. Naturally occurring concentrations of iron and manganese in excess of the guideline values are frequently found in New Brunswick groundwater and, as such, the above noted observations pertaining to the Crane Mountain background groundwater quality data are quite typical of New Brunswick conditions.

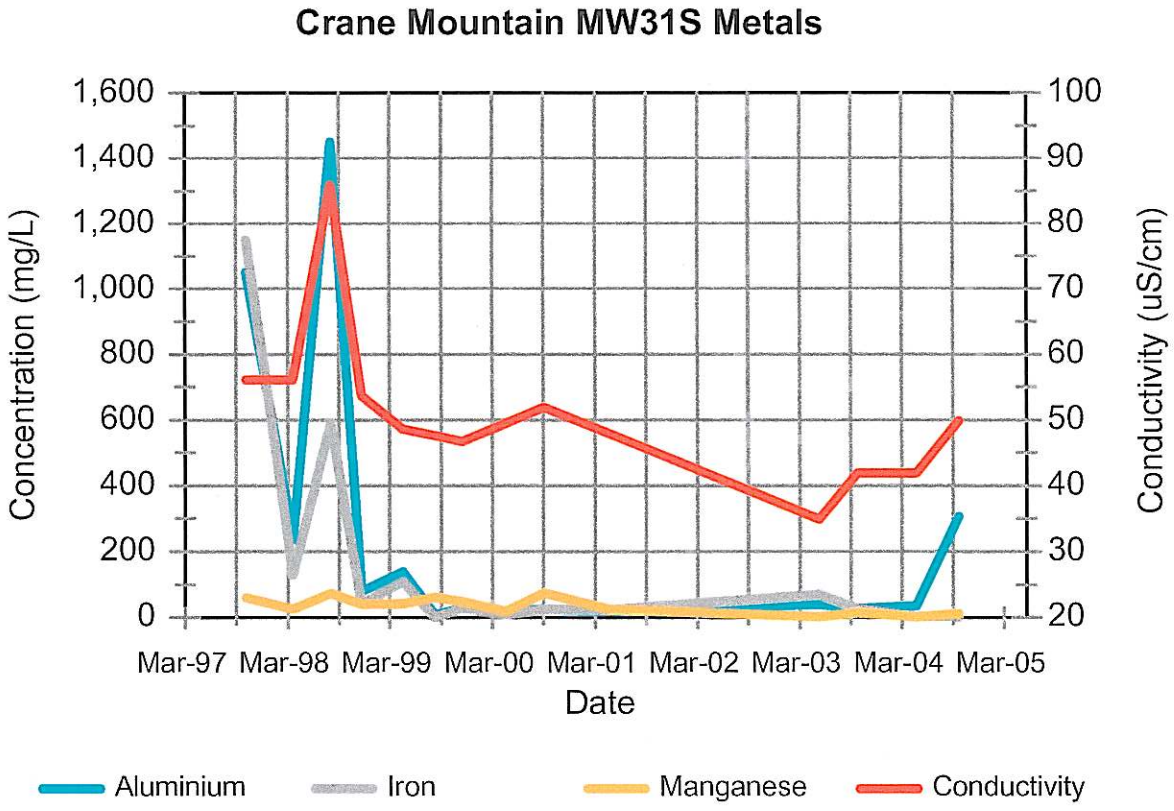
Elevated pH levels outside the recommended range were also identified for selected monitoring locations. Turbidity levels in excess of the guideline value were observed at most monitoring locations. However, it is noted that the guideline values for pH and turbidity have also been established primarily on the basis of aesthetic considerations. Elevated turbidity levels are commonly identified in groundwater samples from 50 mm monitoring wells and are most likely attributable to a lack of well development and the riling of drill cuttings (i.e. disturbance of rock or soil cuttings left over from the drilling process) during sample collection. In addition to the above, concentrations of the trace metal parameters arsenic and antimony in excess of their respective guideline values were observed at a few monitoring locations. The elevated concentrations of these parameters in the background data is most likely reflective of the natural hydrogeological setting of the study area. Naturally occurring minerals in an aquifer can dissolve in the groundwater and result in elevated concentrations of the mineral parameter.

4.4 Adequacy of Background Data

Baseline groundwater and surface water quality data was collected immediately prior to the commissioning of the Crane Mountain facility in the Fall of 1997. The level of effort in this regard was similar to that employed at other regional landfill facilities in the Province and, in general, is considered to be adequate. The background data related to environmental protection was collected during the Environmental Impact Assessment (EIA) of the proposed use of either the Crane Mountain or Paddy's Hill sites for the new solid waste management facility for the Fundy region.

4.5 Identification of Analytical Anomalies

Although most of the fall 2004 monitoring results were similar to the baseline data with no obvious indication of leachate impacts, elevated concentrations of chloride and conductivity were observed for the lower bedrock monitoring well MW46L. It is recommended that



Sample Monitoring Well Results
Figure 4-2

future monitoring results from this location be closely monitored for any increase in parameter concentrations.

Regarding the elevated concentrations of iron and manganese, as previously mentioned naturally elevated concentrations of these parameters in groundwater are quite common in New Brunswick including the Crane Mountain area. Although elevated levels of iron and manganese occur in municipal solid waste landfill leachate, leachate impacted groundwater would be expected to display elevated concentrations of other parameters in addition to iron and manganese (e.g. chloride, conductivity, others).

Some examples of analytical plots (trend plots) that would be useful in identifying analytical anomalies are shown in Figure 4-2. Such plots should be developed and maintained on an ongoing basis.

4.6 Adequacy of Sampling and Testing

We have reviewed the Approval to Operate and find that the stipulated monitoring schedules and analytical suites are similar to the requirements outlined for other Provincial regional landfill facilities. Due the presence of potable water supply wells downgradient and in relatively close proximity to the landfill, the Approval for Crane Mountain includes domestic well monitoring which is not a requirement at many sites due to the absence of nearby wells or other factors.

On the basis of our review, it is our opinion that the compliance monitoring requirements outlined in the Approval are adequate. However, consideration of additional parameters should be completed in the context of the work directed toward identification of "trigger" parameters referenced in the Environmental Management Plan (EMP) for the landfill. The EMP is a document which provides a framework for the administration of environmental issues at the site including environmental compliance monitoring in addition to environmental protection/emergency response planning and environmental training. The emergency response plans (ERP's) included in the EMP outline general corrective actions to be taken in the event that a problem is encountered such as potential leachate impacts on downgradient domestic wells.

4.7 Adequacy of Analysis of Test Data

It is our understanding that analytical testing services for groundwater and surface water compliance monitoring at the landfill site have been provided by Saint John Laboratory Services Ltd. of Saint John, NB. It is our understanding that this laboratory is currently certified by the Canadian Association for Environmental Analytical Laboratories (CAEAL) for selected tests. The mandate of CAEAL is to promote the delivery of high quality analytical services and, therefore, ideally the analytical laboratory charged with analyzing samples from the landfill would be CAEAL certified. However, Section D.77 of the Approval requires only that the laboratory be "approved by the Department" (i.e. New Brunswick Department of the Environment and Local Government). It is unknown whether or not Saint John Laboratory Services is an NBDELG approved laboratory.

4.8 Monitoring Wells Emergency Response Plans

The Emergency Response Plans in the Environmental Management Plan (EMP) outline remedial measures which may be taken in the event that "trigger" concentrations are exceeded for key parameters in the groundwater monitoring data or the domestic well water quality data. The "trigger" concentrations are not defined and it is stated in the EMP that they will be established based on an analysis of background water quality data. Remedial action will only be taken if the results of a more detailed analysis on the water quality data (ASTM PS 64-96 - now ASTM D6312-98 (2005)) indicate that the trigger exceedances are not related to natural background variation.

A trigger concentration may be defined as an upper limit on the expected range of the concentration of a given parameter on the basis of an analysis of the existing water quality database. Trigger concentrations may be defined by a statistical analysis of the existing analytical database or other means such as the adoption of regulatory guideline values. They are in effect action levels whereby if the concentration is exceeded, investigation into the cause of the elevated parameter value is warranted, although not necessarily a problem.

If impacts are detected in the groundwater monitoring data, suggested remedial measures in the EMP include plume delineation; containment of groundwater and remediation by "pump and treat"; and containment of affected groundwater by slurry cut-off or reaction walls or in-situ groundwater remediation by biological and/or chemical means. In general, the suggested remedial approaches are vague and lacking in details. However, a similar level

of effort has been expended in developing remedial measures for other potential environmental liabilities for other landfills in the Province.

Suggested remedial options in the event of the identification of parameter concentrations in domestic well water in excess of "trigger" concentrations include developing alternate water supplies and treating the affected water. Again, the proposed remedial measures are vague but it is acknowledged that conceptual remedial approaches are probably acceptable for EMP purposes.

Consideration should be given to identifying the "trigger" concentrations described above.

5.0 REVIEW OF HANDLING AND CONTROL OF LEACHATE

5.1 Introduction

The leachate management system at the Crane Mountain Landfill includes a number of systems and facilities designed to contain, collect and manage leachate. The basic concept is to contain the leachate in each landfill cell with an engineered liner, collect the leachate in a network of collector pipes that drain to a sump, and pump out the leachate for disposal. Disposal has included treatment on-site at the Zenon plant, and trucking to Saint John's Lancaster treatment plant. Figure 5-1 shows the components of the existing leachate system.

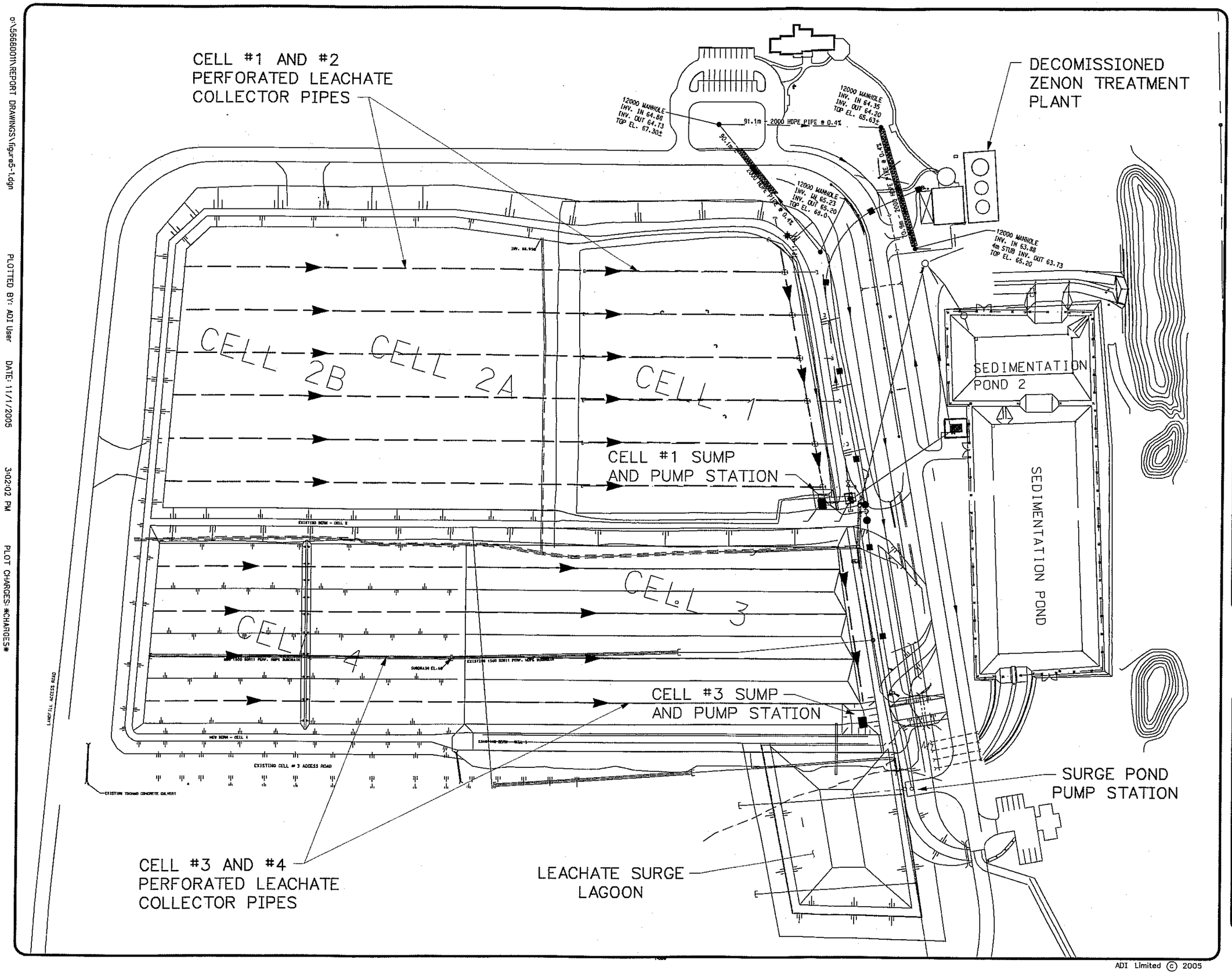
This chapter present the Review of Handling and Control of Leachate, Specification 3.3:

- *Effect of uncapped cells on leachate quantity and quality.*
- *Effect of raising height of cells on integrity of clay and synthetic liners.*
- *Adequacy of material used for cell-capping.*
- *Permeability/breakthrough time of clay liner, under field conditions, relative to recorded heights of leachate in cells (based on studies of three sources of materials tested).*
- *Effect on clay and synthetic liners of using cells as holding ponds.*
- *Pre-treatment of leachate before disposal.*
- *Assessment of interaction between groundwater and surface water.*
- *Surge pond: Integrity of clay liner and synthetic liner, using projected depth of stored leachate.*
- *Identification of chemical composition of leachate.*
- *Adequacy of sampling and analysis of sampling of under-drain layer.*
- *Adequacy of emergency response plans relative to leachate control.*

5.2 Leachate System

Landfill Liner

A landfill liner system is to provide a barrier to contain leachate to prevent contamination of the surrounding environment and to enable collection of the leachate. The engineered liner includes a composite clay and geomembrane hydraulic barrier, plus drainage and protection layers.



No.	Revision	Ckd. By	D

PRELIMINARY

Const. North

Drawn By: OS

Dwg. Standards Ckd. By:

Designed By: TK

Date Printed

Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurem
Project Management

Project Title

INDEPENDENT EXTERNAL REVIEW
OF CRANE MOUNTAIN LANDFILL

Dwg. Title

LEACHATE MANAGEMENT SYSTEM

Project No.	5668-001.1	
Dwg. No.	FIGURE 5-1	Rev. No.
Scale	1:2000	

This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sy
Port Hawkesbury, St.John's, Fredericton and Salem, N

The liner systems for the new Cell #4 and the original Cell #1 are shown in Figures 5-2a and 5-2b, and include the following, from the top down:

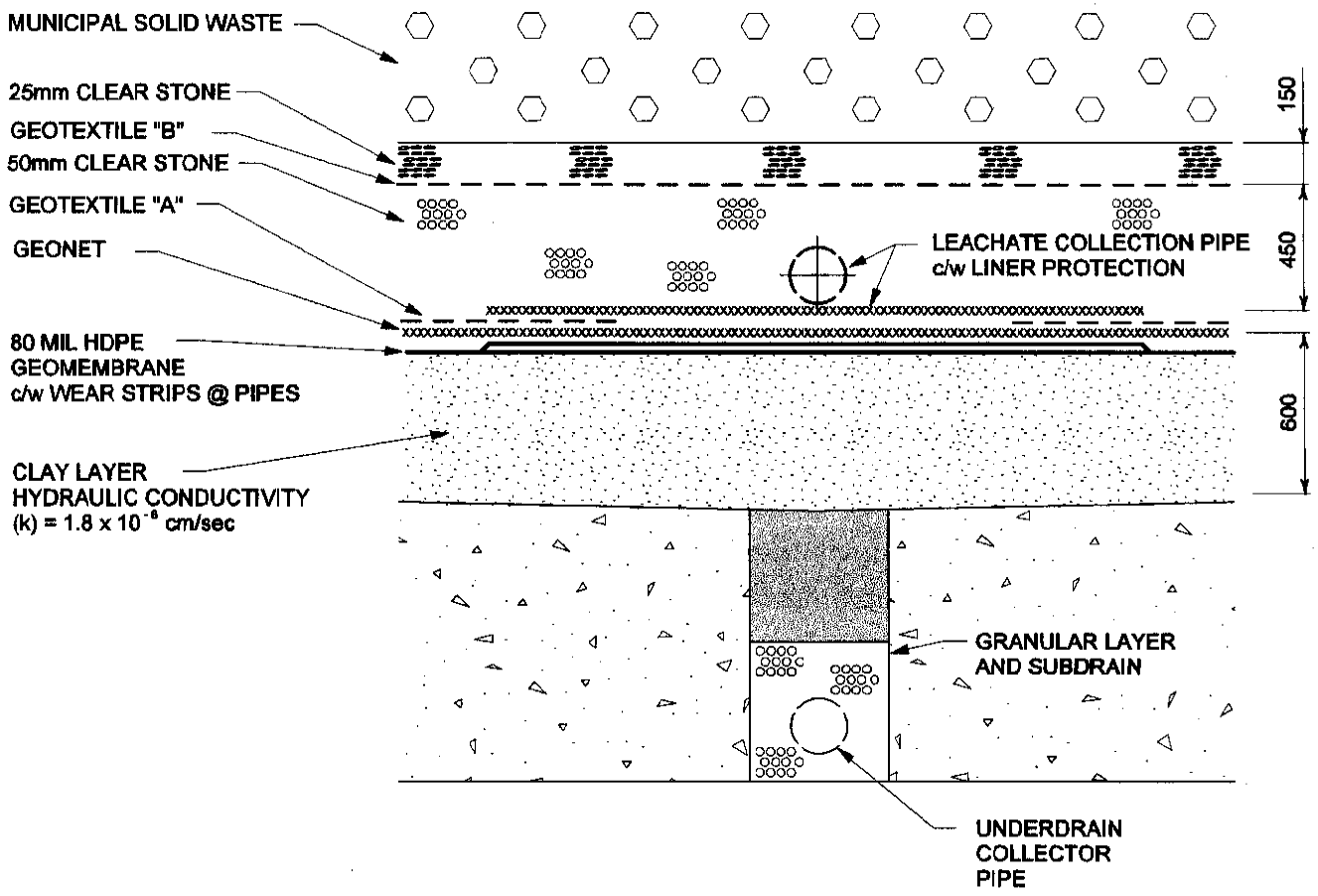
Cell # 4 Liner	Cell # 1 Liner
150 mm layer of 25 mm clear stone	300 mm layer of 75 mm clear stone
Geotextile separation layer	
450 mm layer of 50 mm clear stone	450 mm layer of 25 mm clear stone
Geotextile	Geotextile
Geonet for leachate collection	Geonet
80 mil HDPE Geomembrane	80 mil HDPE Geomembrane
(c/w wear strips at collector pipes)	(c/w wear strips)
600 mm Clay Liner	600 mm Soil Liner
(hydraulic conductivity of 1.8×10^{-8} cm/s)	(Cond. of 2.25×10^{-8} cm/s)

The barrier components are essentially the same for both liners, with the 600 clay layer covered with a 80 mil thick HDPE liner. There have been some variations in the leachate collection granular layer over the geonet and in the top cushion layer. The geonet acts as a drainage layer for leachate collection, and the geotextile functions as a separation layer. Figure 5-2c shows examples of some of the liner components.

The placement of the High Density Polyethylene liner directly over the clay layer creates a composite liner system. This refers to the two liners acting together rather than independently. This means that if a leak in the HDPE liner occurs, the leachate then hits the clay, which is in direct contact with the HDPE. This assists in minimizing leachate from migrating laterally over the clay layer. By comparison, if there was a separation between the two barriers, then a leak in the HDPE layer could freely flow and spread over the clay barrier.

The clay liner in Cell #3 has an increasing clay thickness from 600 mm to up to 1000 mm at the lower east edge, and 1300 mm under the sump.

As means to monitor the effectiveness and integrity of the liner system, there are underdrain/subdrain pipes under the liner system. These consist of perforated collector pipes in granular trenches under the liner. Figure 5-3 shows the location of the existing underdrains and the collection point for sampling.



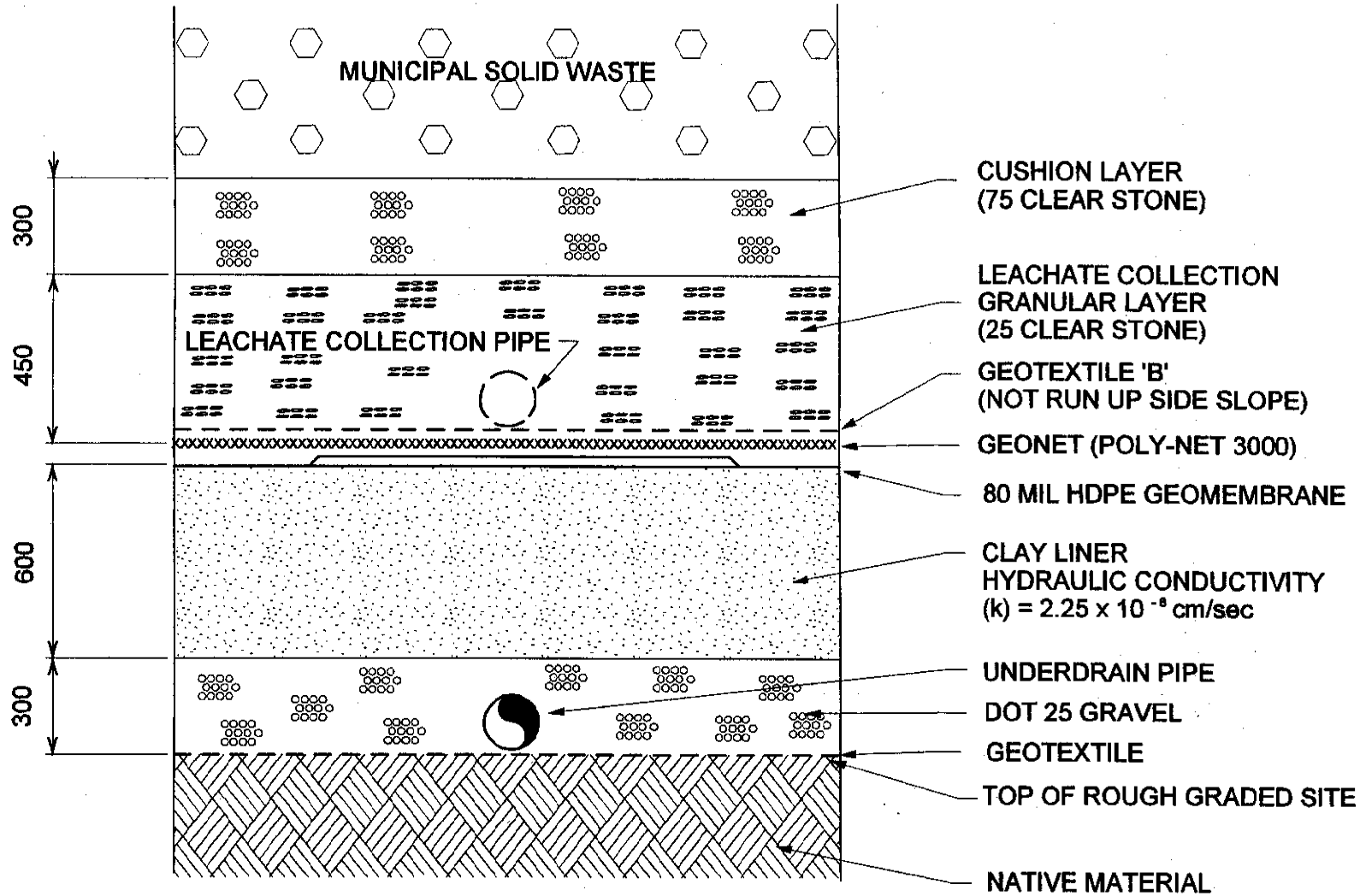
PRELIMINARY

N.T.S.

This drawing is not to be scaled

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.	INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL
Dwg.	CELL #4 LINER DETAILS
Drawn By: JDM	Proj. No. 5668-001.1
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-2A
Designed By: TKO	Dwg Design Ckd By:
	Rev. 0



FOR INFORMATION ONLY

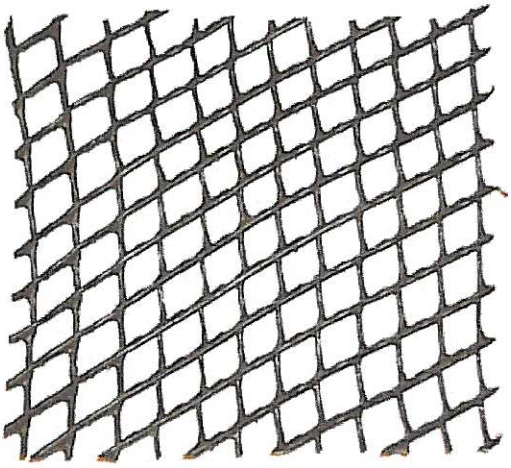
This drawing is not to be scaled

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

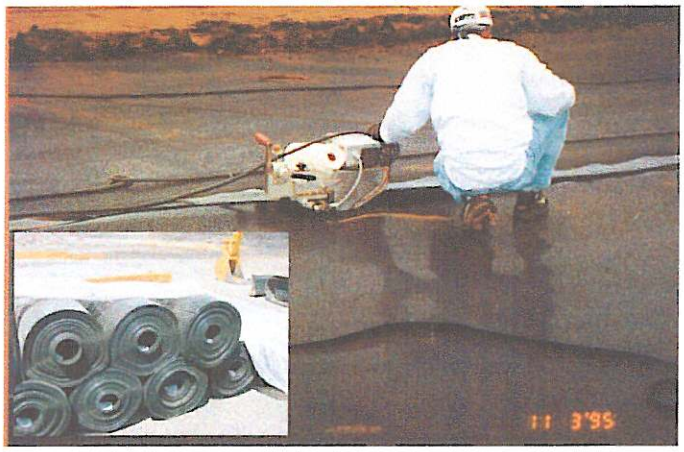
Proj.	INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL
Dwg.	CELL #1 LINER DETAILS

Drawn By: JDM	Proj. No. 5668-001.1	
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-2B	
Designed By: TM	Dwg Design Ckd By:	Rev. 0

Geotextile

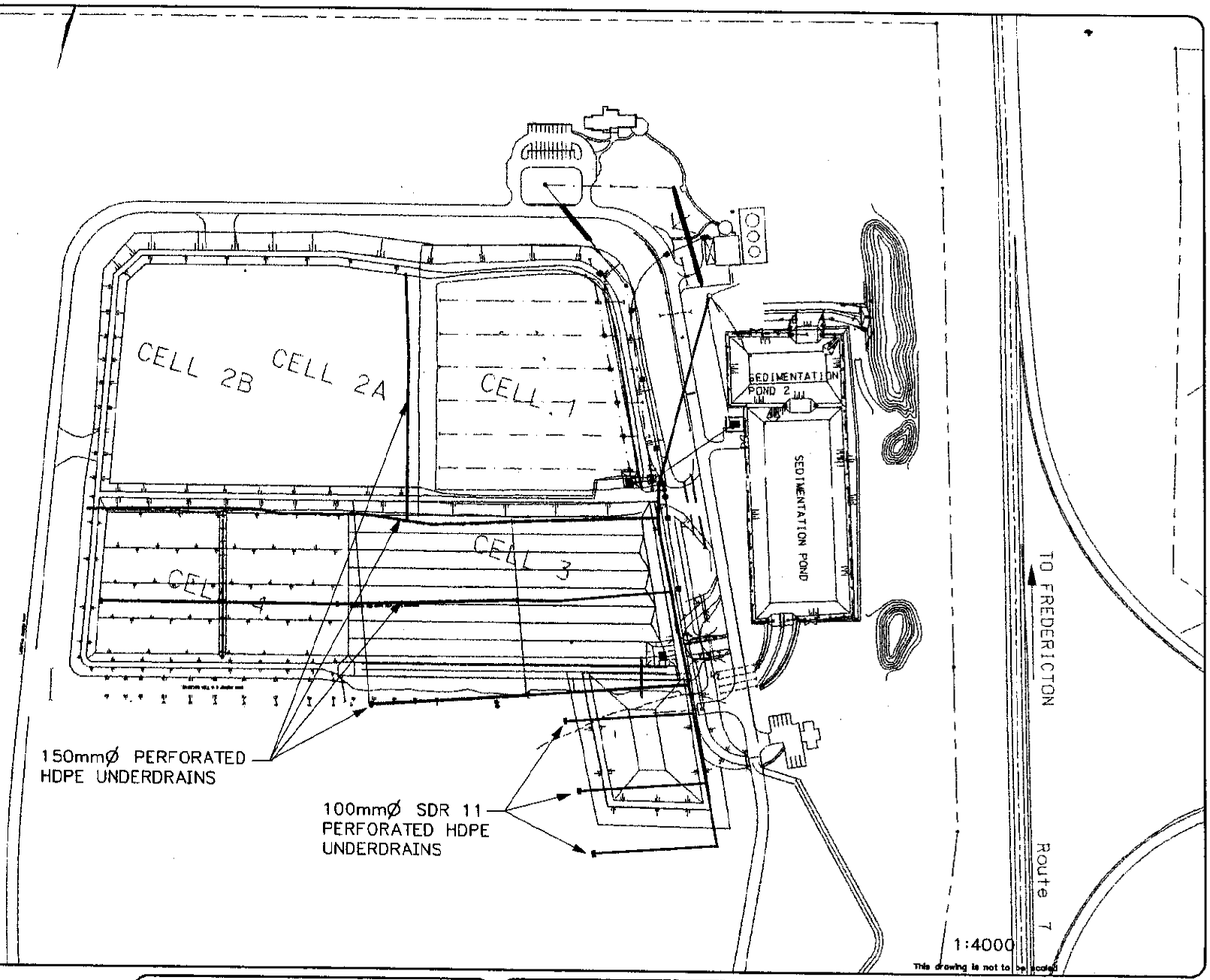


Geonet



HDPE Geomembrane

Geotextile, Geogrid and HDPE Geomembrane
Figure 5-2c



PRELIMINARY

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.
INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg.
LANDFILL UNDERDRAINS

Drawn By: OSE	Proj. No. 5668-001.1	
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-3	
Designed By: TKO	Dwg Design Ckd By:	Rev. 0

Leachate Collection System

The leachate collection system has been designed to facilitate the flow of leachate to the sumps at the bottom end of Cells #1 and #3. It includes the shaping and grading of the liner, the granular materials and geonet over the hydraulic barrier liner, and the leachate collection piping.

The liner has an overall slope of about 1.9 to 2% from the high west side to the low east side. In a north-south cross section, the liner is graded at about 2% towards leachate collector pipes which are spaced at 12.5 m intervals. This gives a multifaceted flow path flow for the leachate. It can flow through the granular layers and geonet towards the low end of the landfill as well as towards the leachate collection pipes.

The leachate collection pipes are 200 mm diameter SDR11 (thick walled) HDPE pipe with four 19 mm diameter perforations spaced at 150 mm along the pipe. The pipes are graded with the liner at about 2 % towards the low east edge of the landfill. The collection piping from Cell #4 connects into the collector pipes of Cell # 3, with the leachate flowing to the east side of the landfill. Likewise the collection pipes in Cell #2 connect into the pipes of Cell #1 with the flow to the low east edge.

A 200 mm diameter perforated HDPE header pipe collects the leachate at the east edge of Cells #1 and #3. These are each graded at about 0.44 % towards the sumps in the low southeast corner of the cells.

Collector Sumps, Pump Stations and Leachate Disposal

Cells #1 and #3 each have a leachate collector sump located in the low southeast corners of each cell. The sumps are used to collect the leachate for pumping out.

The Cell #3 sump is 5.0 m by 5.0 m square, with 1300 mm thick clay layer underneath plus the 80 mil HDPE geomembrane. The invert elevation is 64.8 m compared to the adjacent landfill liner about 65.7 m, giving a sump depth of 900 mm.

The Cell #1 sump is 6.0 m by 6.0 m square with 900 mm thick clay liner plus 80 mil HDPE geomembrane. The sump is 850 mm deep.

The original Cell #1 design included two 500 mm diameter extraction pipes from the base of the sump, up the side of the berm to a discharge manhole. Submersible pumps inserted

down into the extraction pipes would pump the leachate into the manhole, from which the leachate would flow by gravity to the Zenon treatment facility (now decommissioned). This system was converted in 2001 to a pump station constructed over the sump, with the base of the pump station in the sump. The Cell #3 sump also has the pump station located over the sump.

Leachate is pumped out of the collector sumps and into tanker trucks. The leachate is then trucked to the Lancaster treatment plant for disposal.

5.3 Review of Quality Control and Quality Assurance Programs for Construction

The review of Quality Assurance and Quality Control Programs (QA/QC) for construction of the cell barrier systems is based on the summary report for construction of Cell No 3 in 2001. No QA/QC reports were provided for the installation of the geomembrane liner portions of the composite liners for any of the cells.

Also provided for review were a number of reports from 1997 and 1998 related to assessment of the clay borrow sources.

The Gemtec report dated September 1998 detailed an assessment of two clay borrow sources, the Gulf's Clay from Saints Rest Pit and Simpson's Clay from Five Fathom Hole. Three samples from each pit were tested for characterization of the soils. The testing included moisture content, Atterberg Limits, grain size analyses and standard proctor tests. A test pad was constructed from each of the clay sources at the Crane Mountain Landfill site. A Sealed Double Ring Infiltrometer (SDRI) test was performed on each of the test pads. The hydraulic conductivities of the clay based on these SDRI tests were 1.04×10^{-8} cm/sec for the Simpson clay and 9.44×10^{-9} for the Gulf clay. The report stated the field densities of the clay ranged from 85% to 92% of the maximum dry density determined by standard proctor for the Simpson Clay and 82% to 88% for the Gulf Clay. It was noted that these dry density values were in close agreement with the field results for the Galbraith clay used in Cell #1.

A Gemtec letter dated March 30, 1998 provided laboratory test data comparing test results on samples of the Gulf pit and the Simpsons pit to test data from testing performed on samples from the Galbraith Pit performed by Golders and Jacques Whitford and Associates (JWA). The Gemtec data from the testing on the Simpson and Gulf pits provided in this letter was repeated in the September report discussed above. The plasticity index of the

three samples from the Galbraith pit was slightly higher, 23.0 to 27.9, than the plasticity index for the Gulf and Simpson pits which averaged 21.6 to 22.9. Results of hydraulic conductivity tests in a triaxial apparatus were reported for the three clay borrow sources. The hydraulic conductivity of the sample from the Simpson pit was 2.15×10^{-8} cm/sec and for the Gulf pit was 3.29×10^{-8} cm/sec. Four samples were tested from the Galbraith pit, one by JWA and three by Golders. The hydraulic conductivities measured for the four Galbraith samples were 9.5×10^{-9} cm/sec to 1.8×10^{-8} cm/sec. The letter noted that a test pad had been completed at the Crane Mountain site using the Galbraith clay and a SDRI test had been performed on the test pad.

A JWA report dated August 1997 detailed the results of the SDRI test performed on the test pad constructed with clay from the Galbraiths pit. The results of two Air Entry Permeameter (AEP) tests were also presented. The SDRI test displayed a hydraulic conductivity of 1.8×10^{-8} cm/sec. The AEP tests indicated a hydraulic conductivity of 3.3×10^{-10} cm/sec and 6.9×10^{-10} cm/sec. The SDRI test is considered much more representative of the actual hydraulic conductivity of the clay liner due to the larger area of soil tested, longer test duration and the consideration of water lost due to evaporation. The smaller scale AEP test is generally used as a correlation to the SDRI.

Two specifications prepared by Porter Dillon Limited and dated April 1997 were also reviewed. One specification was for the supply of clay and the other was for construction of a soil liner test pad. It was noted that the latter specification specified that the clay was to be compacted with a vibratory drum or roller compactor rather than a pad-foot roller.

No information has been provided to ADI on the directions from the Owner or regulators to Gemtec for performance of QA/QC testing. In addition, more information would be required to properly assess the quality control and quality assurance programs for the clay and geomembrane liners. However, none of the information provided on the composite liner system indicates that it does not meet the NBDOELG guidelines for landfill liner construction.

5.4 Review of Construction of Cells and Lagoons

Liners or barrier systems can be constructed of a number of materials summarized as follows:

1. a natural low permeability soil;
2. a natural soil augmented by the addition of bentonite;
3. a geo-composite material, and
4. a geomembrane.

These materials can be described as follows:

Soil Liner	Liner constructed of compacted lifts of low-permeable soil, soil typically contains at least 35% fines classified as CL or Ch under the Unified Soil Classification System; hydraulic conductivity typically ranges from 1×10^{-6} cm/sec to 1×10^{-8} cm/sec.
Bentonite Soil Liner	Bentonite (clay particles) are mixed with a native soil by tilling or in a pug mill in proportions to achieve the desired hydraulic conductivity, practical limitation probably in the range of 1×10^{-9} cm/sec.
Geo-composite Liner	A manufactured material using geotextiles and/or geomembranes in a laminated form, can consist of bentonite powder between two layers of woven geotextile; hydraulic conductivity in the range of 1×10^{-10} cm/sec to 1×10^{-11} cm/sec; lower conductivity is offset by relative narrow thickness when compared to soil liners.
Geomembrane	Manufactured sheeting generally of rubber or polymer resins, including low density polyethylene (LDPE and HDPE) and polyvinyl chloride (PVC); considered relatively impermeable with hydraulic conductivity in the range of 1×10^{-11} cm/sec to 1×10^{-13} cm/sec.

These materials are used singularly or in combination in a liner system. Liner systems can be a single liner, a composite liner or a double liner system.

In a composite liner, such as used in the Crane Mountain Landfill solid waste cells and lagoons, a primary geomembrane liner is placed in direct contact with an underlying secondary soil or geo-composite liner. The secondary liner serves to slow the rate of leakage through any defects in the primary liner. The performance of the composite liner is affected by the quality of construction as well as the quality of the liner materials. Wrinkles in the primary liner would prevent the required direct contact. The quality of both the secondary and primary liners can be affected by the quality of workmanship during construction.

In a double liner system, a leak detection layer is typically placed between the primary and secondary liners. The cell or lagoon is sloped so that any leakage through the primary liner is directed through the detection layer to one or more sumps. Monitoring of the sumps by inspection by personnel or automated means provides warning of a leak in the primary liner. In a lagoon this would allow the leak to be located and repaired before a head is built-up on the secondary liner to drive leakage through any potential imperfections in the secondary liner.

In practice, in a solid waste landfill cell the presence of the waste above the liner would make locating and repairing the leak in the primary liner very difficult. Removal of the leakage through the sumps would however prevent the buildup of head driving leakage through any potential defects in the secondary liner. In addition there is the possibility that areas with defects in the primary liner may not coincide with areas with defects in the secondary liner.

The most rigorous double liner design would have a composite liner for both the primary and secondary liners. Typically this is not a requirement in New Brunswick. Such a system is generally associated with hazardous waste landfills.

A geonet is the best choice for placement between the primary and secondary liners. A geonet allows quicker flow of leaked fluid to the detection sumps than a granular media.

A thorough quality control and quality assurance (QA/QC) program is essential to the construction of an effective liner system.

Another consideration in liner design is whether to cover the liner to prevent degradation due to environmental or physical attack. A drawback is the loss of the ability to visually inspect the liner. Geomembranes can lose plasticizers due to exposure to ultraviolet (UV) radiation in sunlight. HDPE and other geomembranes contain carbon block to counteract UV degradation. Studies have shown that exposed geomembrane can perform satisfactorily through extended service periods.

Granular cover can provide protection against physical damage if carefully installed to prevent damage to the liner when being placed.

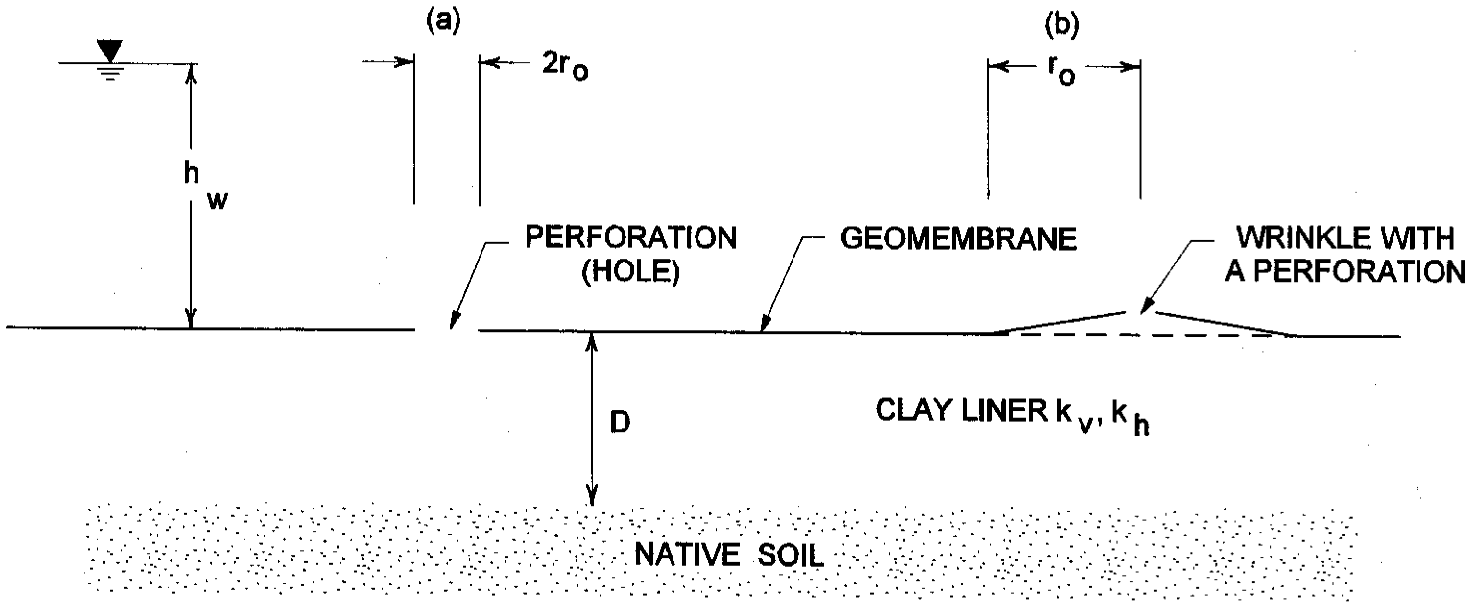
It should be noted that all liner systems will leak to some extent due to the nature of the materials available or damage during construction. The volume and rate of leakage can be

reduced to acceptable levels by selection of liner materials and good quality control of construction.

The rate of leakage through a geomembrane liner, through permeation, is negligible compared to the rate of leakage through defects in the geomembrane. If there is a defect in the geomembrane in a composite liner, the liquid flows first through the geomembrane defect, then laterally some distance between the geomembrane and the soil, and finally vertically through the low-permeability soil layer. The distance the fluid flows between the geomembrane and the soil interface determines the wetted area of the soil liner. This distance is determined by the quality of contact between the geomembrane and the soil. The volume of leakage through the soil liner is proportional to the wetted area. Good contact means no wrinkles and a smooth, well compacted soil surface which requires good quality control of construction. This is illustrated in Figure 5-4.

Other factors affecting the rate of flow through a composite liner are the size of the hole in the geomembrane liner, the hydraulic conductivity of the soil layer and the head of the liquid on the geomembrane.

A number of papers have illustrated a comparison of the leakage rates through the various types of liner options. This is based on work originally done by Giroud and Bonaparte in 1989. The following table illustrates the representative calculated leakage rates through the liner types for a liquid head of 30 cm, and shows the improvement due to the soil liner portion of the composite liner.



PROBLEM DEFINITION SHOWING (a) HOLE OF RADIUS r_o IN GEOMEMBRANE IN INTIMATE CONTACT WITH CLAY LINER AND (b) WRINKLE WITH PERFORATION - EFFECTIVE "HOLE" RADIUS r_o IS FOR ZONE WHERE GEOMEMBRANE IS NOT IN INTIMATE CONTACT WITH THE CLAY LINER (GCL) OR (CCL)

h_w = FLUID (e.g. LEACHATE) HEAD ON GEOMEMBRANE

D = THICKNESS OF CLAY LINER

k_v = VERTICAL HYDRAULIC CONDUCTIVITY OF CLAY LINER

k_h = HORIZONTAL HYDRAULIC CONDUCTIVITY OF CLAY LINER

FOR INFORMATION ONLY

This drawing is not to be scaled

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.	INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL
Dwg.	COMPOSITE LINER ISSUES

Drawn By: JDM	Proj. No. 5668-001.1	
Dwg Standards Chk. By:	Dwg. No. FIGURE 5-4	
Designed By: TM	Dwg Design Ckd By:	Rev. 0

Table.1 - Calculated Leakage

Liner System Type	Condition	Leakage Rate
Soil Liner	Hydraulic Conductivity (k) = 1 x 10^{-6} cm/sec	1200 gal/acre/day
Soil Liner	k = 1 x 10^{-7} cm/sec	120 gal/acre/day
Geomembrane Only	30 holes/acre average area of hole (a) = 0.1 cm^2	10,000 gal/acre/day
Geomembrane Only	1 hole/acre , a = 1.0 cm^2	3300 gal/acre/day
Geomembrane Only	1 hole/acre, a = 0.1 cm^2	330 gal/acre/day
Geo-composite Liner	Soil Liner Thickness (D) = 1 m, k = 1 x 10^{-6} cm/sec Geomembrane 30 holes/acre, (a) = 0.1 cm^2	100 gal/acre/day
Geo-composite Liner	Soil Liner D = 1 m, k = 1 x 10^{-7} cm/sec Geomembrane 1 hole/acre, a = 1.0 cm^2	0.8 gal/acre/day

The above discussion is intended to illustrate some options in the event it was decided that a more secure barrier system is required for future waste cells and lagoons to protect the potable water aquifer down gradient of the site.

5.5 Comments on Current Construction Practice at Crane Mountain Landfill

The underdrain system in place beneath the waste containment cells and the surge pond are a positive feature of the current design at the Crane Mountain Landfill. These underdrains, through monitoring of discharges, could help detect any leakage through the barrier systems of the waste cells and lagoons.

The waste cell liner system in Cell #3 and Cell #4 consists of 600mm of granular fill placed over a geotextile and geonet which immediately overly the geo-composite liner system. The geo-composite liner consists of an 80 mil HDPE geomembrane over 600 mm of clay soil. Unless the granular fill is covered by an additional insulation layer, this design is inadequate

to prevent potential freeze-thaw damage to the clay soil layer. If the liner system is left exposed during freezing conditions, the performance of the clay portion of the barrier system could be impaired.

The liner design of the surge pond has a couple of issues for consideration. From the plans reviewed, the liner system consists of a protective geotextile over a geocomposite liner consisting of 80 mil textured HDPE geomembrane over a 600 mm thick clay soil layer. Due to the function of the surge pond it is anticipated that the lagoon is empty when not required to hold excess leachate. This would mean that the clay layer beneath the HDPE geomembrane potentially could be subject to environmental damage due to dessication and freeze-thaw damage. Therefore the clay layer may not be as effective as intended.

It should be noted that the clay/geomembrane barrier design of the surge pond is reasonable and the presence of the underdrains allows detection of potential leaks. A lagoon liner design consisting of an HDPE geomembrane over a sand layer, including the underdrain leak detection system would be probably as effective and cheaper to construct.

Compaction of clay soil generally is performed with pad-foot rollers which have a beneficial effect kneading the soil breaking down clods, blending successive lifts of soil and therefore reducing the hydraulic conductivity of the compacted clay soil. However, the specifications used in construction of the clay layers at Crane Mountain were interpreted as specifying smooth drum compactors, which do not have the beneficial kneading effect.

5.6 Effect of Uncapped Cells on Leachate Quantity and Quality

At present, only a portion of the landfill has been capped. The closed areas include the north slope of Cells #1 and #2, and the east slope of Cell #1, which were capped in 2001. The capped area is about 1.86 ha, while the open area totals about 6.63 ha to the boundary of Cell #3. Half of Cell #4 will be brought into operation this fall, which will bring the total uncapped area to 7.70 ha. Once Cell #4 is fully operational, the uncapped area will increase to 8.75 ha.

Much of the waste deposited in the landfill cells has not been capped to date. This certainly contributes to the excess volumes of leachate generated causing problems at the site. It is noted that the FRSWC plans to raise the elevation of the completed cells an additional 15 m, and this is the stated reason capping has not been completed. The benefits of placing a

temporary capping system of for instance 30 cm of clay soil could be assessed relative to the cost.

As portions of a landfill are filled to capacity, they can then be closed by capping the landfill cell. Capping involves covering the landfill with a barrier to reduce the infiltration of water into the landfill and therefore reduce the amount of leachate generated. This is the concept that has been assumed in the planning of the Crane Mountain Landfill and has been included in the Approvals to Operate.

Other closure concepts permit some rainwater infiltration in order to accelerate the breakdown of the waste within the landfill, and increase the associated gas generation rate. This reactor-type concept is not the documented strategy for the Crane Landfill. Given Saint John's high rainfall events, this approach would increase the demands on the leachate management system.

The quantity of landfill leachate generated is related to the amount of precipitation that falls on the landfill, evaporation, take up by plants and how much clean water is diverted off of the landfill. The main variable that can be controlled is the amount of water diverted off the landfill. This is done through *progressive closure* of the landfill as each zone is completed. At present, only the far slope at the end of the landfill is capped, and therefore precipitation on the rest of the landfill can become leachate. The FRSWC's plan is to raise the height of the landfill and therefore the closure, or capping, of Cells 1 and 2 has been postponed.

The extent of the open landfill areas is increasing the amount of leachate generated at the site. This has resulted in the need to construct the Surge Pond as a leachate storage structure for extreme wet weather conditions.

The concept of *progressive closure* involves closing each cell as it is completed. This approach helps to reduce the amount of leachate generated, reduce odours, improve gas collection (where used) and provide a finished landscaped surface. Implementation of this strategy would mean that portions of Cells #1 and #2 could be closed when Cell #3 was put into operation, and Cell #3 could be capped in 2006.

In November 2004, the FRSWC made a submission to the Department of Environment and Local Government to raise the height of the landfill from 90 meters to 105 meters. The response from the DOELG included an extensive list of questions (53 in a Dec. 10, 2004 letter and 4 more in a Dec. 14, 2004 letter). Subsequently in 2005, the FRSWC withdrew their application. They have verbally indicated that they are considering closing Cells #1

and #2, and then reapplying for the increase in landfill height for Cells #3 and #4 and the rest of the landfill. Capping Cells #1 and #2 would be beneficial in reducing leachate volumes and controlling odours.

The concept of raising the height of the landfill has schematically been presented in the figures attached to the FRSWC application. It shows the layout of the finished landfill built up to the 105 m level. However, the plan does not include the Surge Pond, which we understand is meant to be a permanent facility at the landfill. It is therefore suggested that the concept plan be updated to reflect the Surge Pond, as well as the possible capping of Cells #1 and #2 at the 90 m level.

The Surge Pond creates a significant cutout in the landfill footprint, which changes the final contour plan. An approximate final contour plan is shown in Figure 5-5 which shows the final contours to the 105 m level with the Surge Pond incorporated into the concept. It becomes evident from this plan that Cells #1, #2 and #3 become partly isolated from the rest of the landfill and cannot effectively be raised to the 105 m level. Hence, these three cells should be brought to final grade for closure. It is noted that a portion of Cell #2 cannot be capped until the grades of the adjacent Cell #4 reach the 90 m level.

The design of Cell #5 should reflect the overall concept for the landfill height, capping schedule and leachate operational strategy.

5.7 Effect of Raising Height of Cells on Integrity of Clay and Synthetic Liners

The assessment of the effect of raising the height of the landfill cells by Gemtec appears reasonable. Since the side slopes will be maintained at a maximum slope of 4 to 1, the stress on containment berms will not be increased. Therefore, shearing forces on liner features should not be excessive.

A possible area of concern with the increased height of the landfill would be if there were any pipe penetrations through the HDPE liner. The design of the landfill cells does not include any pipe penetrations and therefore this issue is not applicable to this site. The design for leachate removal includes the pump station directly over a sump within the landfill footprint.

It was understood that at the initiation of the Crane Mountain Landfill, the height of the landfill cells was restricted by the environmental approval due to visual aesthetic reasons.

By increasing the height of the landfill, the life of the landfill would be extended by about ten to fifteen years to about 2048.

5.8 Adequacy of Material Used for Cell-Capping

The Approval to Operate, Item 70, defines the requirement for the final cover. It includes the following:

- 300 mm granular layer
- 600 mm low permeability clayey till @ 1 x 10^{-7} cm/sec hydraulic conductivity
- 150 mm granular protection layer
- 150 mm growing medium and vegetative cover.

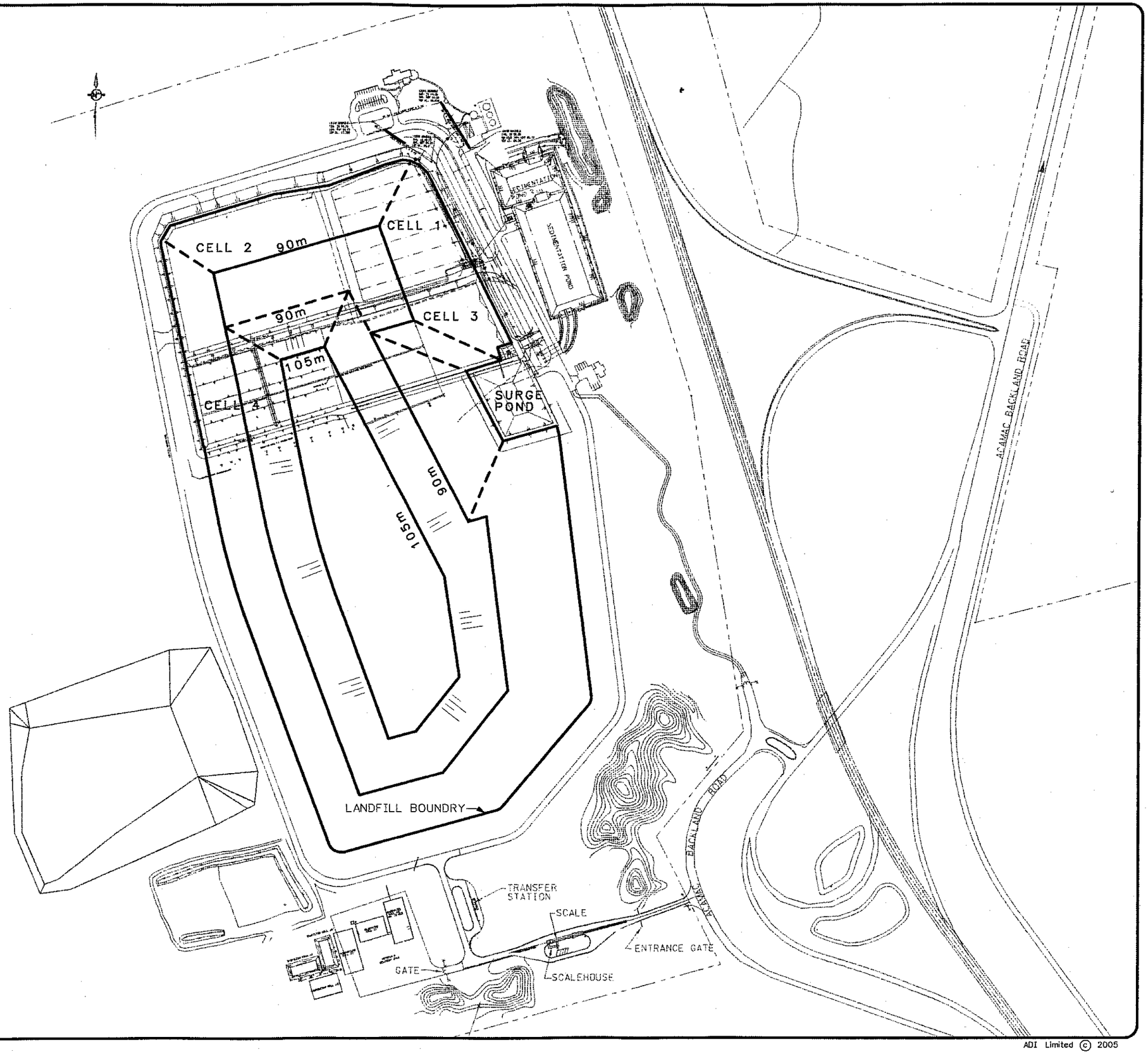
The final cover is to have a minimum slope of 2% on the top of the landfill, and the sideslopes are not to exceed 4 horizontal to 1 vertical.

The existing capping of the landfill includes closure of the north slope of Cells #1 and #2, and the east slope of Cell #1. The landfill cap consists of the following components from the top down:

- erosion control blanket
- 200 mm topsoil layer
- 1000 mm frost protection layer
- geotextile separation layer
- 200 mm clear stone drainage layer
- geotextile separation layer
- 500 mm clay layer barrier layer ($k \leq 1.8 \times 10^{-8}$ cm/sec)
- geotextile separation layer
- 300 mm clear stone gas venting layer
- waste

This cover system would be an effective capping system.

The landfill cover installed uses a thinner 500 mm clay barrier layer compared to the specified 600 mm clayey layer. The difference is justified by using a clay with a specified minimum hydraulic conductivity of 1.8 x 10^{-8} cm/s, compared to the specified value of 1 x 10^{-7} cm/s.



ADI Limited © 2005

No.	Revision	Ckd. By	Date

PRELIMINARY

Const. North

Drawn By:

Dwg. Standards Ckd. By:

Designed By:

Date Printed

Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement
Project Management

Project Title

INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. Title

CONCEPTUAL FINAL CONTOUR PLAN

Project No.	5668-001.1	
Dwg. No.	FIGURE 5-5	Rev. No. C
Scale	1:5000	

This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydn
Port Hawkesbury, St.John's, Fredericton and Salem, NE

In addition to the capping barrier layers, there is a gas venting system and a large drainage swale to intercept stormwater runoff and direct it to the ditch that surrounds the landfill.

A lysimeter test pad was proposed for installation on the top of Cell #1. The pad test would be for evaluating the effectiveness of the landfill cover system in providing a barrier to water infiltrating through the cover. Due to cost issues and the time of year for construction, the lysimeter test pad was not constructed.

As a temporary measure, intermediate cover must be placed on any areas that are inactive for at least three months. Intermediate cover consists of a 300 mm layer of cover material.

5.9 Permeability/ Advective Breakthrough Time of Clay Liner

Engineered landfill facilities are typically constructed with low permeability (hydraulic barrier) liner systems. Two primary functions of the liner system are 1) to minimize the amount of leakage through the bottom of the liner, and 2) to retain liquid such that it drains via the leachate collection and recovery system.

Transport through low permeability liner systems is governed by two processes: advection and diffusion. Advection is the process wherein contaminants are transported with the flowing fluid (e.g. leachate in the cell) under the driving force of a hydraulic gradient resulting from build up of fluid on the liner. Diffusion is the process whereby contaminants are transported under the influence of their kinetic activity in the direction of their concentration gradient (i.e. from higher concentration to lower concentration).

In New Brunswick, landfills are typically constructed of a minimum two layer system which consists of a geosynthetic membrane (plastic) liner (the primary liner), which is in turn placed over a recompacted soil liner of minimum 600 mm thickness. Depending on the nature of the soil used to compact the liner, a secondary plastic liner (typically HDPE geomembrane) may be required below the primary liner. In this case, a secondary drainage layer (typically a geonet, i.e. a manufactured plastic drainage medium) is placed between the primary and secondary geomembrane liners. The geonet can serve for leachate detection and/ or as a secondary leachate collection layer in the event of leakage through the primary liner. In general, the three layer system (i.e. two geomembranes above the soil liner) can be considered a more conservative design as it provides 1) a mechanism to reduce the hydraulic head on the underlying soil liner in the event of a breach in the primary liner, 2) it provides a secondary recovery layer in the event of leakage through the primary liner, and 3) generally

offers greater probability of detecting leakage through the primary liner versus a simple underdrain that may not extend over the total area of the landfill cell(s).

A primary design requirement for an engineered municipal landfill liner system in New Brunswick is a minimum 25 year advective breakthrough time. In estimating the advective breakthrough time, to be conservative, it is generally required that the protection provided by the primary liner be disregarded, and that the breakthrough time be calculated assuming that only the secondary liner system is functional. In the case of the two layer system (e.g. primary HDPE geomembrane liner over recompacted soil liner) only the underlying soil is left, whereas in the case of the three liner system (i.e. primary and secondary geomembrane and underlying soil liner), two layers are present once the primary layer is discounted, i.e. the secondary geomembrane liner and the soil liner.

In the case of the Crane Mountain site, it is understood that the liner consists of an 80 mil HDPE primary liner over 600 mm thick recompacted soil liner; i.e. the two layer hydraulic barrier system. In this case, for the purpose of the breakthrough calculation, it is assumed that only the soil liner layer is present. The advective transport velocity used to determine breakthrough time is calculated using Darcy's Law:

$$v = q/n = Ki/n$$

where:

v	is the flow velocity
q	is the Darcy flux
n	is the liner porosity
K	is the hydraulic conductivity
i	is the hydraulic gradient across the liner given by the difference in head divided by the thickness of the liner

Using a typical landfill design leachate depth of 0.3 m (i.e. depth of leachate buildup on the liner), the breakthrough time is 31 years which is 6 years longer than the minimum requirement of 25 years. It is understood that existing and/ or proposed operating conditions for the landfill suggest that leachate depths on the order of 0.8 m may be expected. Under these conditions, breakthrough time would decrease to 20 years.

Concerning the limited documentation on liner breakthrough time provided for review (i.e. Gemtec letter report dated January 18, 2005 File 658.66), the discussion of breakthrough warrants additional detail. For example, it is not intuitively obvious based on review of the text discussion and graph provided how the theoretical leachate front in the liner is at that

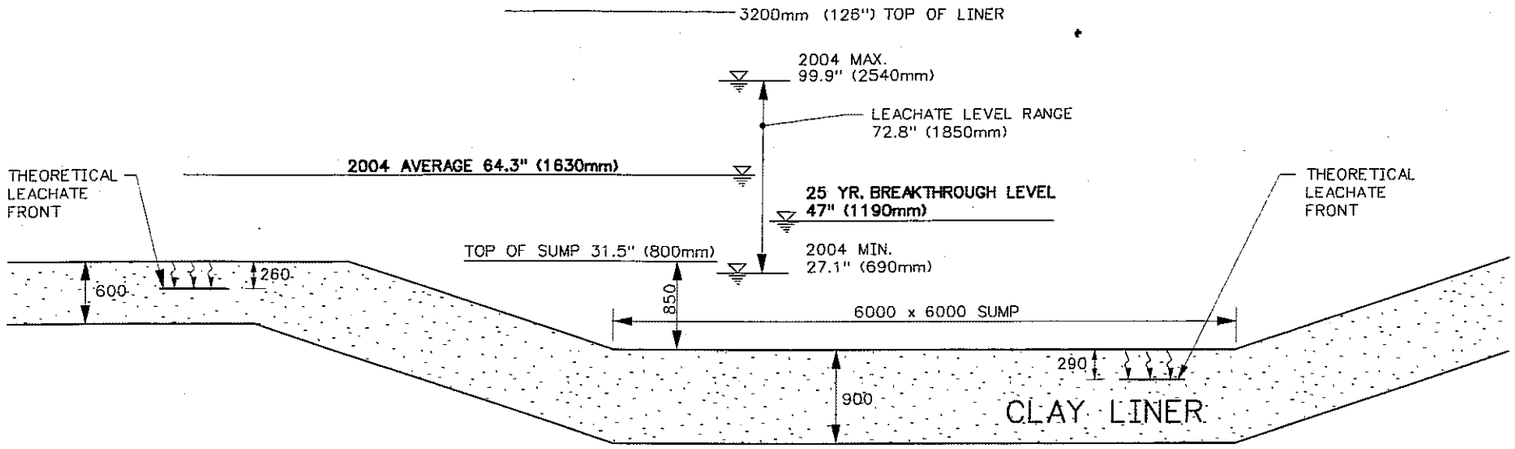
time (i.e. January, 2005) at 0.25 m (i.e. from November, 1997 to January, 2005; a period of 8 approximately years), and would still meet the 25 year breakthrough period. More detail on assumptions and calculations is warranted to document the discussion provided in the January 18, 2005 Gemtec letter.

It noted that for many engineered landfills including some constructed in New Brunswick, native soil used to construct the liner is glacial till. This material typically will not have as low a hydraulic conductivity as that cited for the clay used at the Crane Mountain facility. For these sites, it is typically necessary to use the primary and secondary geomembrane liner system with a drainage layer between the two. Where this is used, it is generally allowed to assume that the head on the liner system below the primary liner is equal to the thickness of the drainage layer/ geonet under the primary liner, and the secondary liner functions as a barrier layer. The lower leachate depth (c.g. 0.006 m for a representative geonet) on the secondary liner and soil liner, combined with the assumption of lower flux through the system provided for by the presence of the secondary geomembrane are generally sufficient to meet the 25 year breakthrough requirement.

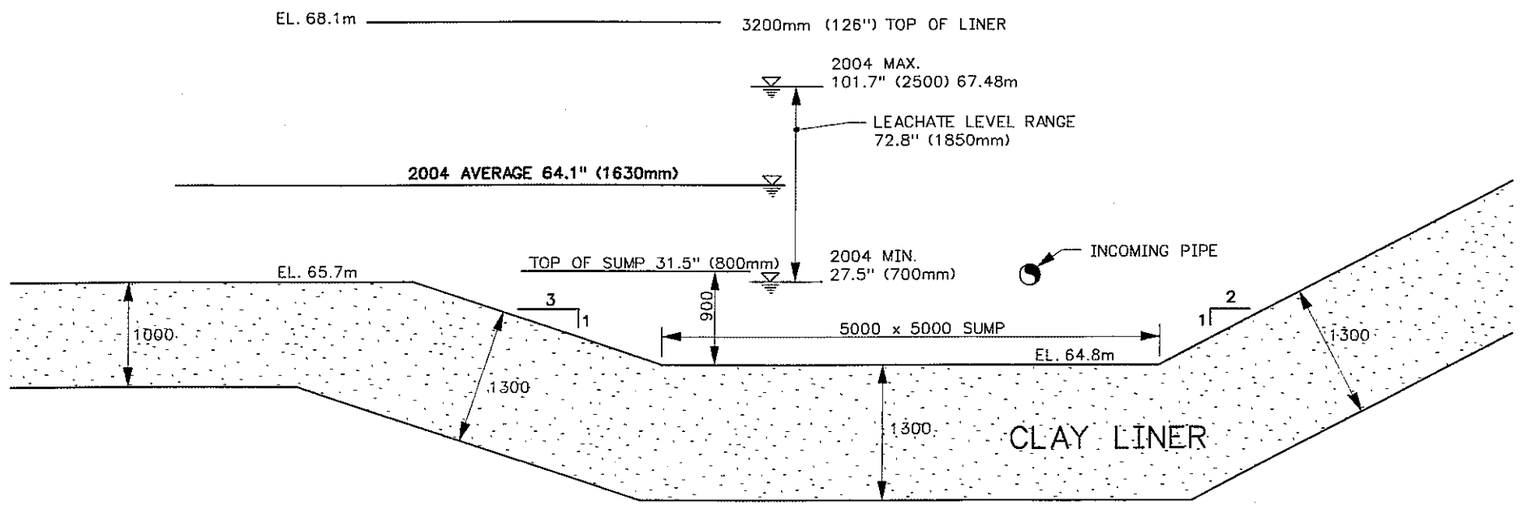
The added advantage(s) of the secondary liner and geonet below the primary liner is as noted above; it provides for secondary leachate collection provided by the geonet and to some degree lessens reliance on the soil liner as the sole source of containment if the primary liner is discounted. For these reasons, it is suggested that the three layer system offers superior protection. Concerning the Crane Mountain site, it is noted that the hydraulic conductivity of the soil liner is at the lower end of that typically encountered for soil liner materials in New Brunswick, i.e. it is extremely important that the field hydraulic conductivity be definitively proven and verified in laboratory and field QA/QC testing. As well, the fact that there is an inherent greater reliance placed on the soil liner in the simple two layer system warrants additional attention to such factors as potential degradation of the soil liner (e.g. resulting increase in hydraulic conductivity) in the event of contact of leachate with the soil liner.

5.10 Effect on Clay and Synthetic Liners of Using Cells as Holding Ponds

To our knowledge, use of cells as holding ponds is unorthodox landfill management practice in New Brunswick. Generally, landfills are designed, constructed and operated so that leachate is removed from the disposal cells. One reason for this is to prevent buildup of leachate head on the liner. In the context of the Crane Mountain site with its simple two layer design and no geonet under the primary liner to provide for secondary leachate



CELL #1 SUMP



TOP OF SUMP 31.5"= 800mm
TOP OF LINER 126.0" = 3200mm

CELL #3 SUMP

No.	Revision	Ckd. By	D

PRELIMINARY

Const. North

Drawn By: OS
Dwg. Standards Ckd. By:
Designed By: TK
Date Printed
Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurem
Project Management

Project Title
INDEPENDENT EXTERNAL REVIE
OF CRANE MOUNTAIN LANDFILL

Dwg. Title
CELL #1 AND CELL #3
SUMP DETAILS

Project No. 5668-001.1
Dwg. No. FIGURE 5-6
Rev. No.
Scale N.T.S.
This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sy
Port Hawkesbury, St.John's, Fredericton and Salem, M

collection, it is suggested that increasing head on the liner by allowing the cells to serve as holding ponds does not promote conservative landfill operational practice in the context of management of variables relevant to consideration of advective breakthrough of the liner. It is understood that the landfill cells are used to temporarily store excess leachate volumes during periods of heavy infiltration. The drawback to this function would depend on the resulting head of the leachate over the liner.

The leachate levels within the Cell #1 and Cell #3 sumps are measured daily, except on weekends. The recorded data is summarized in the following tables. Figure 5-6 shows the cross-sections of the two sumps and the associated leachate levels.

Leachate Levels in Cell #3 Sump (inches)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg.
2002													
Min:						36.3	41.6	50.4	38.0	28.8	51.0	68.1	28.8
Max:						44.5	75.5	73.0	81.6	76.6	85.2	99.8	99.8
Avg:						41.4	59.0	63.3	66.6	51.7	69.9	84.9	**64.5**
2003													
Min:	61.9	30.7	31.5	68.7	59.6	9.8	11.7	14.5	24.4	45.9	70.0	62.0	9.8
Max:	72.3	93.7	114.2	103.8	98.5	57.8	64.7	87.5	54.0	110.2	104.5	93.1	114.2
Avg:	66.8	70.4	64.4	84.0	85.0	35.7	35.3	63.5	38.5	64.2	81.0	82.2	**64.0**
2004													
Min:	46.5	30.9	39.8	38.5	36.3	37.2	33.8	34.7	75.9	27.5	29.9	28.4	27.5
Max:	78.5	64.5	89.9	84.5	68.3	63.8	67.5	76.3	86.0	75.8	95.2	101.7	101.7
Avg:	61.5	46.0	64.7	68.6	54.4	50.1	56.6	60.8	80.8	58.9	71.0	88.1	**64.1**

Note: Leachate Levels are relative to a Top of Sump elevation of 31.5 inches.

Leachate Levels in Cell #1 Sump (inches)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg.
1998													
Min:					27.6	25.2	10.6	16.1	16.9	36.2	19.2	16.5	10.6
Max:					53.9	56.7	62.6	66.9	68.1	69.7	79.5	83.5	83.5
Avg:					46.2	45.6	48.6	33.4	34.3	55.9	56.4	42.6	**45.8**
1999													
Min:	52.7	57.1	59.4	21.2	22.1	23.7	22.9	64.1	27.7	81.7	89.0	93.7	21.2
Max:	98.0	93.2	108.1	98.5	100.0	75.9	65.3	101.8	114.1	104.4	102.1	104.4	114.1
Avg:	77.4	74.1	89.8	46.1	49.9	50.1	32.7	84.2	70.6	92.6	96.1	98.8	**71.1**
2000													
Min:	73.4	72.6	80.1	29.2	22.4	28.2	28.7	22.7	28.4	24.3	28.6	56.2	22.4
Max:	102.4	112.5	106.5	86.7	86.4	81.1	67.1	57.7	74.9	70.2	86.4	100.1	112.5
Avg:	90.0	88.9	88.3	70.6	51.3	44.3	45.9	34.3	45.6	49.7	52.6	74.8	**61.0**
2001													
Min:	30.4	30.0	31.5	72.5	56.7	75.5	26.5	26.1	55.2	74.5	80.2	69.2	26.1
Max:	78.9	61.5	85.0	99.8	91.5	82.3	75.3	80.0	94.2	96.4	90.2	90.7	99.8
Avg:	66.1	36.6	62.6	85.4	75.1	78.7	58.1	54.8	80.5	86.0	87.1	82.5	**70.8**
2002													
Min:	40.2	53.1	91.5	97.2	96.9	82.9	80.1	80.2	78.9	87.1	93.8	99.7	40.2
Max:	90.0	108.7	116.1	112.5	106.8	88.1	100.1	89.1	112.0	111.2	120.9	119.6	120.9
Avg:	64.1	86.6	97.4	101.1	102.2	84.8	87.0	82.9	94.4	96.2	104.8	108.8	**92.8**
2003													
Min:	82.7	38.4	39.7	59.0	43.5	30.0	24.6	40.0	33.3	65.9	60.9	30.0	24.6
Max:	89.4	91.5	120.6	109.6	97.9	68.3	71.9	96.2	71.0	106.5	104.7	108.4	120.6
Avg:	85.5	76.5	81.2	82.4	75.8	48.7	51.4	71.6	59.4	84.2	73.5	90.9	**73.0**
2004													
Min:	65.2	46.0	39.8	36.0	39.8	43.9	35.7	32.2	48.5	33.0	29.7	27.1	27.1
Max:	87.8	66.8	99.9	97.9	78.6	68.2	72.8	73.8	81.8	63.9	84.2	83.7	99.9
Avg:	74.0	54.0	74.3	77.7	63.0	56.6	61.3	60.0	67.4	47.6	67.0	65.2	**64.3**

Note: Leachate Levels are relative to a Top of Sump elevation of 31.5 inches.

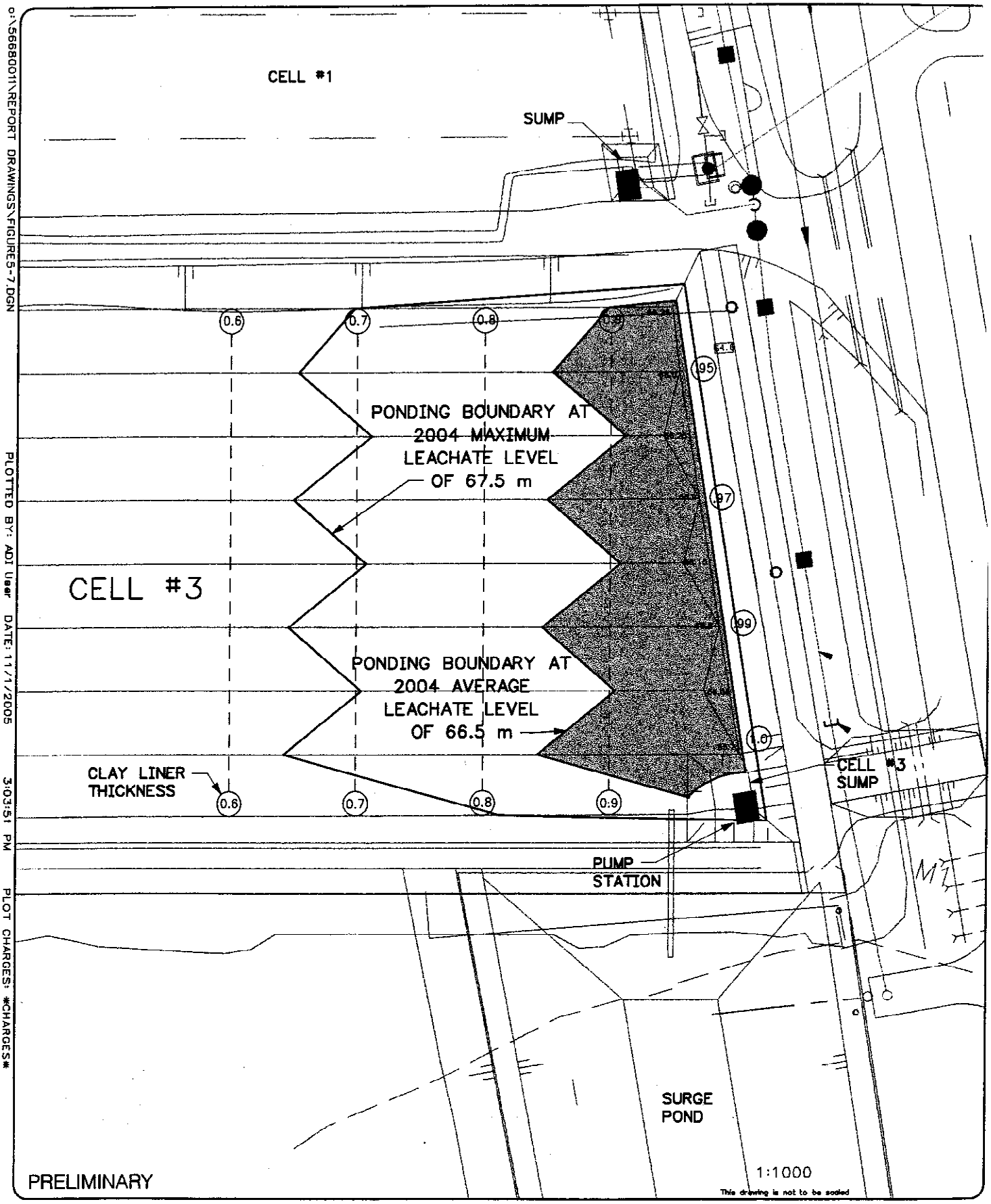
The data indicates that the leachate level in the Cell #3 sump has averaged around 64 inches over the past three years. The leachate level in the Cell #1 sump has varied significantly, with annual averages ranging from a low of 46 inches in 1998 to a high of 93 inches in 2002. The 2004 average level was 64 inches, or 1625 mm.

Compared to the top sump elevation of 31.5 inches, the average head over the landfill liner adjacent to the sump is about 33 inches, or about 840 mm.

The 2004 annual average leachate level in the two sumps were very similar at 64.1 and 64.3 inches. This leachate head is greater than the maximum average value of 47 inches needed to meet the 25 year breakthrough criteria for the Cell #1 600 mm thick liner (June 21, 2005 Gemtec letter regarding Review of Leachate Breakthrough Through Clay Liner). It is also noted in the same letter that the theoretical leachate penetration of the clay liner would be 260 mm in the Cell #1 liner and 290 mm in the 900 mm thick Cell #1 sump. These calculations are based on the clay barrier only, and would therefore theoretically represent an assumed leak in the HDPE liner since the landfill began operation.

To meet the design objective of a minimum 25 year breakthrough time in the clay liner, it is recommended that the leachate level within Cell #1 be maintained as low as possible at all times. At present the leachate level is affected by the frequency in which the leachate pumped to the tanker trucks for transport to the Lancaster treatment facility. The leachate level could be lowered by increasing frequency of pumping out the sumps. As an initial measure, consideration could be given to automating the system so that the excess leachate is pumped directly to the Surge Pond. The long term solution, which the FRSWC is evaluating, is to construct a pump station and forcemain that would discharge at the Lancaster treatment plant. This would allow direct pumping of leachate to the treatment plant.

It is noted that the design of Cell #3 includes a thicker 1300 mm clay layer under the leachate collector sump. As well, the cell liner has been gradually thickened from 600 mm to 1000 mm at the lower east end of the landfill. The area with the thicker clay layer appears to generally correspond to the area that is flooded when the leachate is ponded within the cell as shown in Figure 5-7. This design improvement provides a higher quality barrier system. This would seem to reflect the operational concept of some leachate storage in the sump and lower portion of the landfill.



o:\566800011\REPORT DRAWINGS\FIGURE5-7.DGN PLOTTED BY: ADI User DATE: 11/1/2005 3:03:51 PM PLOT CHARGES: *CHARGES*

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.
INDEPENDENT EXTERNAL REVIEW
OF CRANE MOUNTAIN LANDFILL

Dwg.
CELL #3
2004 LEACHATE
PONDING LEVELS

Drawn By: OSE	Proj. No. 5668-001.1
Dwg. Standards Chk. By:	Dwg. No. FIGURE 5-7
Designed By: TKO	Dwg. Design Chk. By:
	Rev. 0

5.11 Pretreatment of Leachate Before Disposal

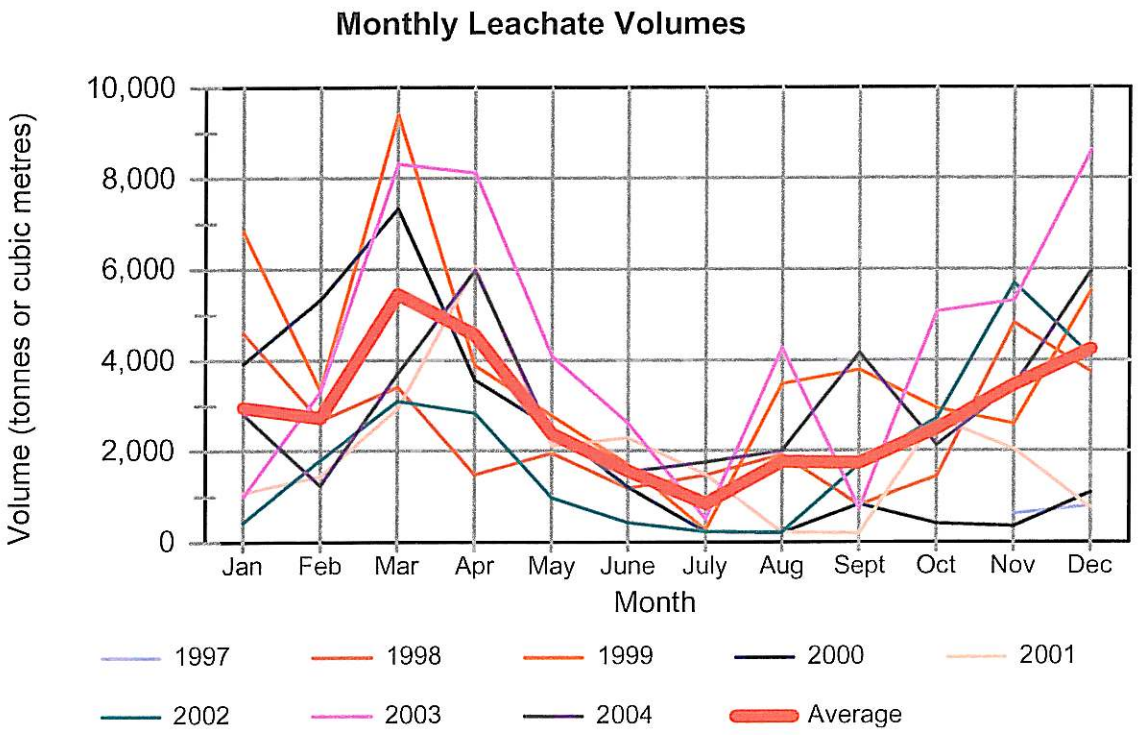
Pretreatment of the leachate before disposal is a requirement of the Approval to Operate. This included treatment at the Zenon Facility prior to discharge to the manmade wetland, and pretreatment of the leachate trucked to the City of Saint John's Lancaster treatment plant. In 2004 operation of the Zenon Facility was discontinued. Now all leachate is trucked to the Lancaster treatment plant. The high operating cost of the Zenon Facility was the primary reason for closing the plant.

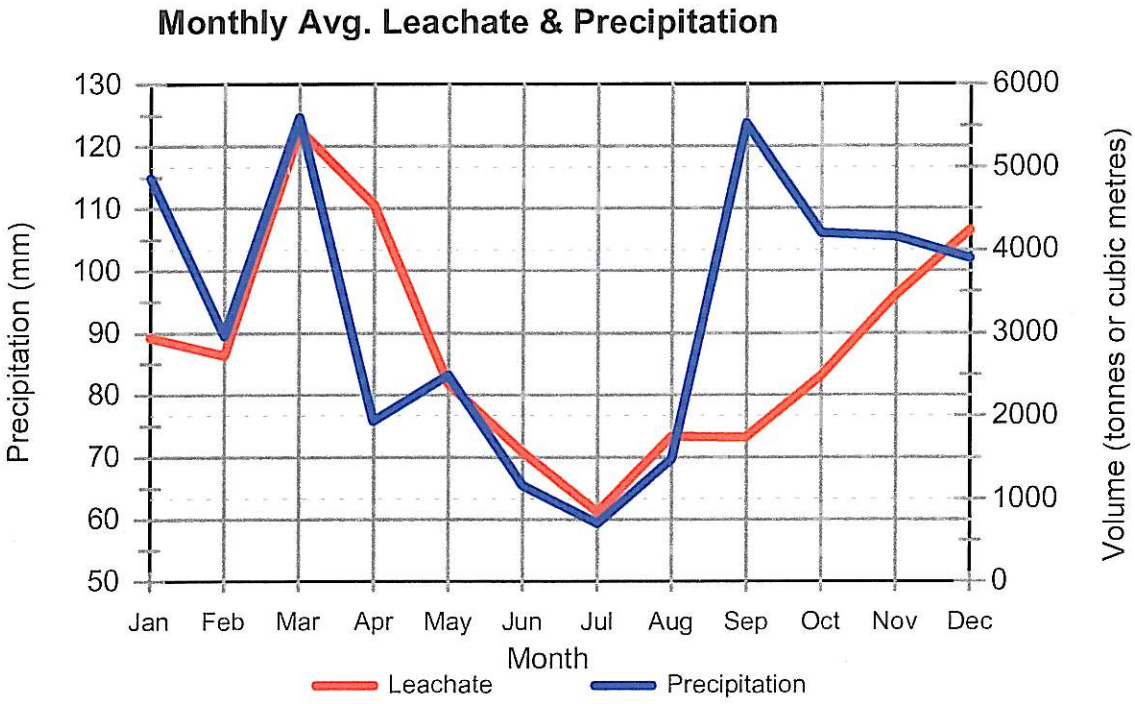
The treatment at the Zenon Facility was to a level that would allow discharge to Mellinger Brook. The discharge standards were defined in Items 72 and 73 of the Approval, for pH and dissolved oxygen. Additional requirements were specified in Items 92 to 100. The key discharge criteria include: a pH between 6.5 and 9.0; a dissolved oxygen level of 5.5 to 9.5 mg/L; general chemistry and trace metals meeting the requirements of the Canadian Environmental Quality Guidelines for the Protection of Drinking Water; and the Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life.

It is understood that the permeate (treated leachate) from the Zenon Facility met the discharge requirements of the Approval to Operate, but could not treat all the leachate generated at the landfill.

For discharge to the Lancaster treatment plant, Item 93 of the Approval to Operate calls for pretreatment to a level below the maximum allowable influent contaminant levels for discharge to the treatment plant. Historical data shows that at times the BOD level of the leachate exceeds the Lancaster limit of 400 mg/L. The Approval calls for pretreatment, but instead the FRSWC appears to have negotiated a penalty clause in their discharge agreement, whereby the FRSWC is charged a premium for the discharge of high BOD leachate.

The amount of leachate discharged to the Lancaster treatment plant and to the Zenon Facility are summarized in the following table. Also included is the annual rainfall totals. The rainfall data is from the Saint John Airport. To more accurately assess the comparison between rainfall and leachate generation rates, it is suggested that a rainfall monitoring gauge be installed at the landfill site.





Monthly Leachate and Precipitation
Figure 5-8

Leachate Volumes Generated (tonnes or m^3)

	1997	1998	1999	2000	2001	2002	2003	2004
Jan		4597	6829	3924	1069	423	987	2804
Feb		2661	3336	5331	1439	1804	3302	1241
Mar		3403	9397	7335	2937	3090	8308	3708
Apr		1470	3888	3561	6061	2828	8125	5979
May		1951	2772	2512	2116	969	4083	2295
June		1179	1710	1198	2294	420	2610	1530
July		1463	265	231	1469	216	502	1750
Aug		1920	3472	199	212	207	4270	2002
Sept		808	3786	828	183	1699	729	4156
Oct		1435	2939	395	2715	2723	5061	2126
Nov	613	4816	2591	349	2033	5692	5298	3432
Dec	795	3741	5501	1086	744	4094	8598	5951
to Lancaster	**1,408**	**29,444**	**46,486**	**26,950**	**23,273**	**24,165**	**51,874**	**36,973**
Zenon Plant						24,944	16,194	4,290
Total Volume	**1,408**	**29,444**	**46,486**	**26,950**	**23,273**	**49,109**	**68,068**	**41,263**
New Cells	Cell 1	½ Cell 2	Cell 2			½ Cell 3	Cell 3	
Closure			Sides Cell 1		Side Cell 2			
Rainfall (mm)	979	1,137	1,237	1,186	799	1,332	1,256	1,036

Figure 5-8 shows a plot of the monthly leachate volumes. Despite annual variations, a general pattern can be noted. Leachate flows typically peak in March, then progressively drop to a low in July, followed by an increase back to March. Also shown on Figure 5-8 is a comparison of the average monthly leachate volumes compared to the average monthly rainfall depths. There appears to be a general correlation between the rainfall and leachate volumes, with a degree of soaking up precipitation after the summer.

The annual leachate totals show a significant variation from year to year. The variation is influenced by the annual rainfall, number of cells in operation and when the sideslopes were capped. For example, the lowest annual rainfall was in 2001, the same year that the leachate

volume was lowest. Figure 5-9 shows a comparison between the annual leachate volumes and the annual precipitation on the landfill. The precipitation is shown for the total landfill area of each year and also the precipitation on the net area, which is the total landfill area minus the closed areas.

The FRSWC long-term leachate management strategy calls for the discharge of all leachate at the Lancaster treatment plant. The City of Saint John commissioned a study suitability of the leachate discharge to be handled by the Lancaster plant, and concluded that it is acceptable. Hence the City and FRSWC are presently negotiating an agreement for the long-term disposal of leachate.

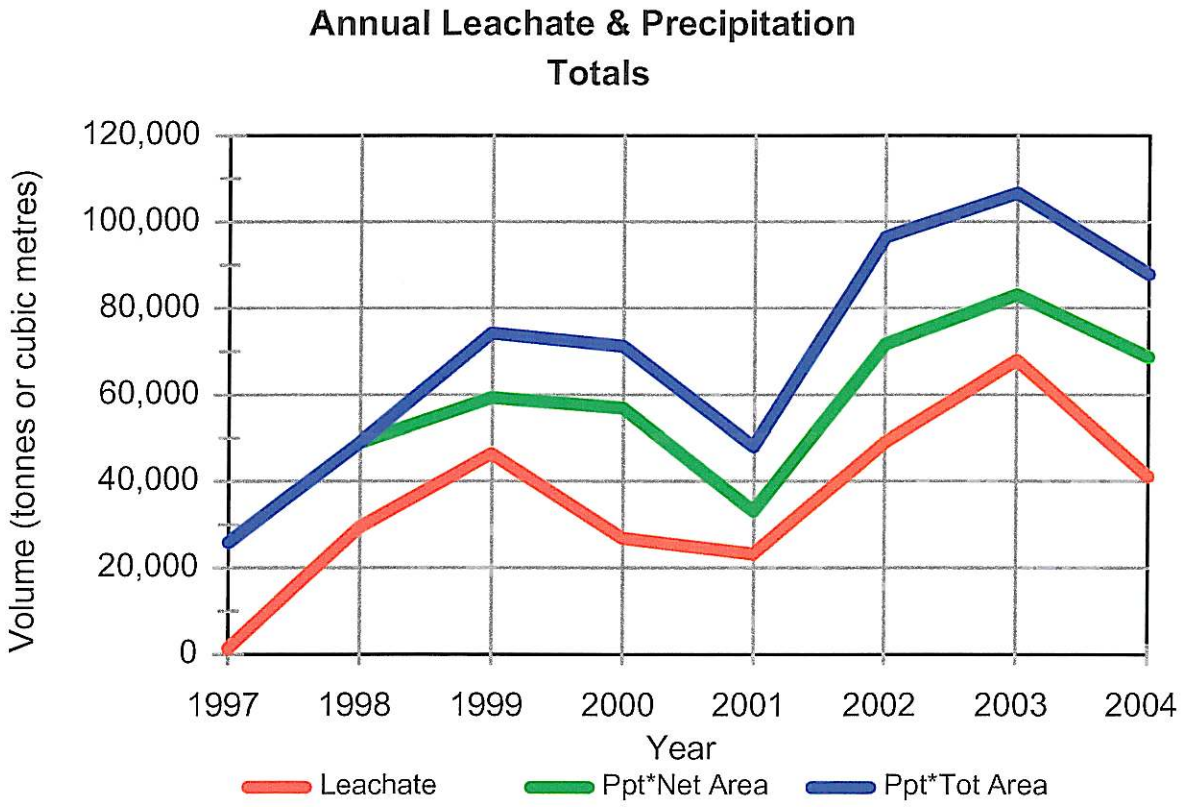
The Approval to Operate requires amendment to reflect the current leachate management practices. This includes the closing of the Zenon plant and the discharge of all leachate to the Saint John's Lancaster treatment plant without pretreatment.

An option that could be considered is pretreatment of leachate in the Surge Pond. This could be done if it was found that the BOD levels were regularly exceeding the Lancaster facility limit of 400 mg/L. Aerators could be installed in the Surge Pond for leachate pretreatment. This would be done in conjunction with using the Surge Pond to lower the leachate levels in the landfill cells.

5.12 Assessment of Interaction Between Groundwater and Surface Water

There is potential for interaction between the shallow groundwater flow system and surface water in the study area. To our knowledge, there has been limited assessment of groundwater and surface water interaction at this site. However, surface water monitoring is completed at the site on a regular basis.

The interaction between groundwater and surface water removal was also considered based on the estimated water budget for the site. The majority of the landfill site is located within the watershed of a small stream, Mellinger Brook, which flows northeast and discharges to the Saint John River at Martinon Beach. The approximate area of this watershed is 425 ha. Utilizing surface water flow data for a watershed of similar size in the province, the mean flow in Mellinger Brook was estimated to be 0.1 m^3/s which equates to about 9,500 m^3/day. By comparison, the average daily leachate flow during the period of maximum uncapped area has been estimated by others to be on the order of 210 m^3/day. Currently, leachate from



Net Area = Total Area - Closed Area

Annual Leachate and Precipitation
Figure 5-9

Crane Mountain facility is ultimately trucked to the Lancaster wastewater treatment facility for final treatment.

The rough calculations indicate that, even under the assumption of maximum leachate generation, the effect of trucking leachate out of the watershed would be expected to have a nominal impact on the hydrology of the landfill watershed.

5.13 Surge Pond: Integrity of Clay Liner and Synthetic Liner

The surge pond was built to operate as an emergency leachate storage facility. Whenever the amount of leachate being generated cannot be controlled by trucking to the Lancaster treatment plant, the excess leachate is to be pumped into the Surge Pond. Once the leachate flows stabilize and the trucking capacity is greater than the leachate flows, then the Surge Pond is to be pumped out.

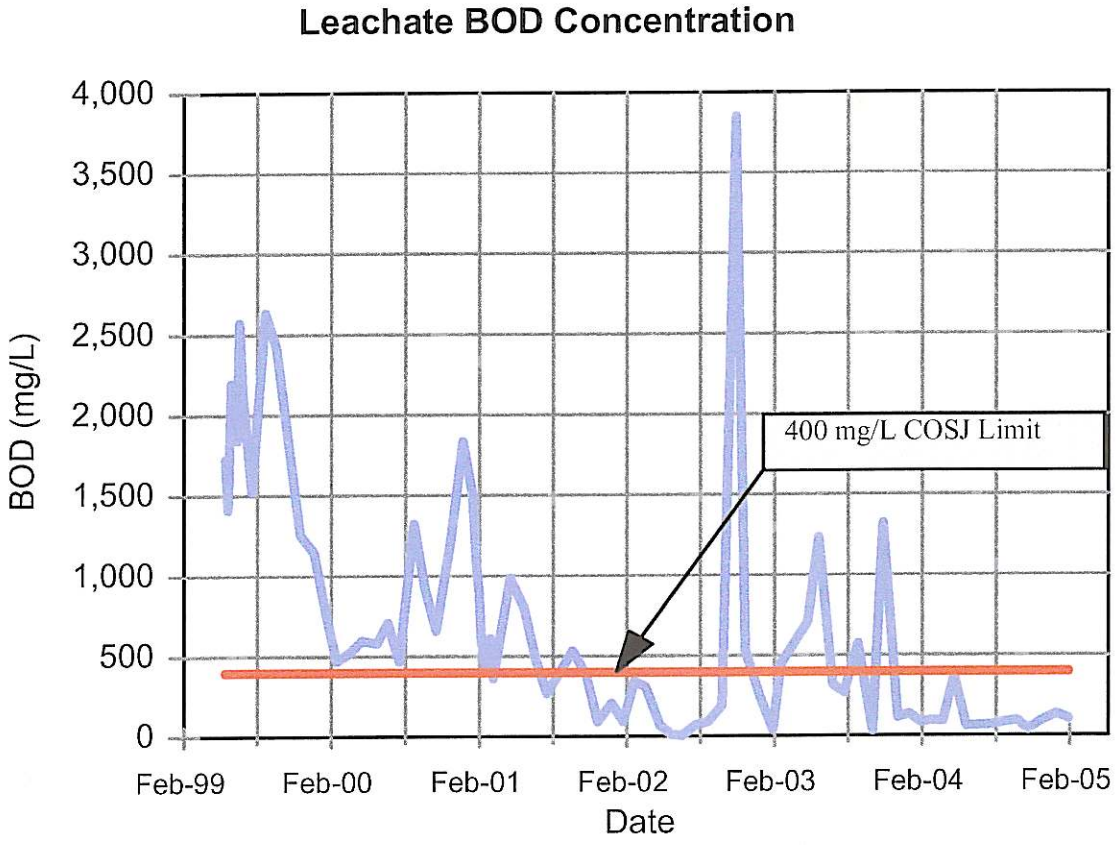
Any impacts on the clay liner and synthetic liner of the surge pond would occur during relatively short-term rainfall events. Therefore despite the increased depth of leachate over the liner system, the risk of breakthrough is not considered a critical issue.

It has been suggested earlier in this section that leachate could be pumped automatically from the landfill cells into the Surge Pond, and then pumped from the pond into the tanker trucks. If this leachate management approach was implemented, then the leachate levels in the Surge Pond would be maintained at a higher level for longer periods of time. It is therefore suggested that a double liner system be considered with this approach.

5.14 Identification of Chemical Composition of Leachate

Leachate volumes and characteristics have been monitored at the landfill. A typical leachate parameter monitored is biochemical oxygen demand (BOD_5). Figure 5-10 shows a graphical depiction of the raw leachate concentrations from 1999 to 2005.

BOD_5 is a measure of the organic strength of leachate and is a good leachate strength indicator parameter. Overall, the BOD_5 was observed to be highly variable and to range in concentration from <100 mg/L to a high of 3850 mg/L. However, a general declining trend with time is noted, with the exception of some higher levels between November 2002 and November 2003. After that, the levels have stabilized at very low values.



Leachate BOD Concentrations
Figure 5-10

The declining BOD_5 levels were especially prevalent shortly after August, 2001 which coincides with the opening date of the composting facility. This result would be expected since the composting process diverts approximately 7,000 tonnes of organic material from the landfill.

As an example, the 2004 leachate BOD levels are presented in the following table. The annual average BOD_5 concentration was about 140 mg/L during 2004. This concentration tends to be significantly lower than that observed for other provincial landfill facilities.

2004 Leachate BOD Levels (mg/L)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	523	41	50	123	189	3	87	84	63	6	41	252
	521	43	60	146	166	3	63	32	82	6	38	242
	203	258	87	218	243	16	55	32	113	6	69	252
	205	309	73	252	322	24	67	32	132	28	60	255
	194	287	101	345	373	69	88	32	139	35	22	258
	197	299	145	326	324	72	78	32	139	44	66	252
	168	203	136	266	230	105	58	32	151	38	110	255
	134	211	87	276	225	69	32	44	151	32	101	258
	121	202	54	319	193	63	38	82	158	35	98	249
	81	192	55	269	171	63	44	63	107	38	101	255
	95	10	47	260	171	76	44	74	227	38	98	258
	131	59	38	246	63	85	44	74	214	35	101	260
	145	57	39	228	102	45	44	76	271	38	94	246
	165		36	278	55	36	41	76	176	47	66	
	160		46	**460**	8	49	32	83	132	35	118	
	173		60	278	24	63	58		164	35	168	
	158		69	**460**	79				145	38	172	
	160		60	278	87				151		242	
	192		58	**460**					170		246	
	798			**793**					145		249	
	38			**578**								
	52			**530**								
				468								
				378								
				370								
				273								
				229								
Avg.	210	167	68	337	168	53	55	57	152	31	113	253

Values in excess of the Lancaster Treatment Plant limit of 400mg/L have been highlighted. The annual average of these 2004 BOD measurements is 139 mg/L.

5.15 Adequacy of Sampling and Analysis of Sampling of Underdrain Layer

The scope of the underdrain sampling and analysis program at Crane Mountain is similar to that required at other facilities in the Province. The underdrains, shown in Figure 5-3, provide a sample from underneath the landfill liner system. Sampling is conducted in accordance with the Approval to Operate, which requires general chemistry and trace metal analysis five times a year.

Figures 5-11 and 5-12 show trend plots for some of the results of general chemistry and metals from the underdrains UD2 and UD3. The plotted metals include iron and manganese which are typical leachate indicator parameters. Chloride, pH and conductivity have been included in the general chemistry graph. These types of graphs can be used to monitor for trends in the test results.

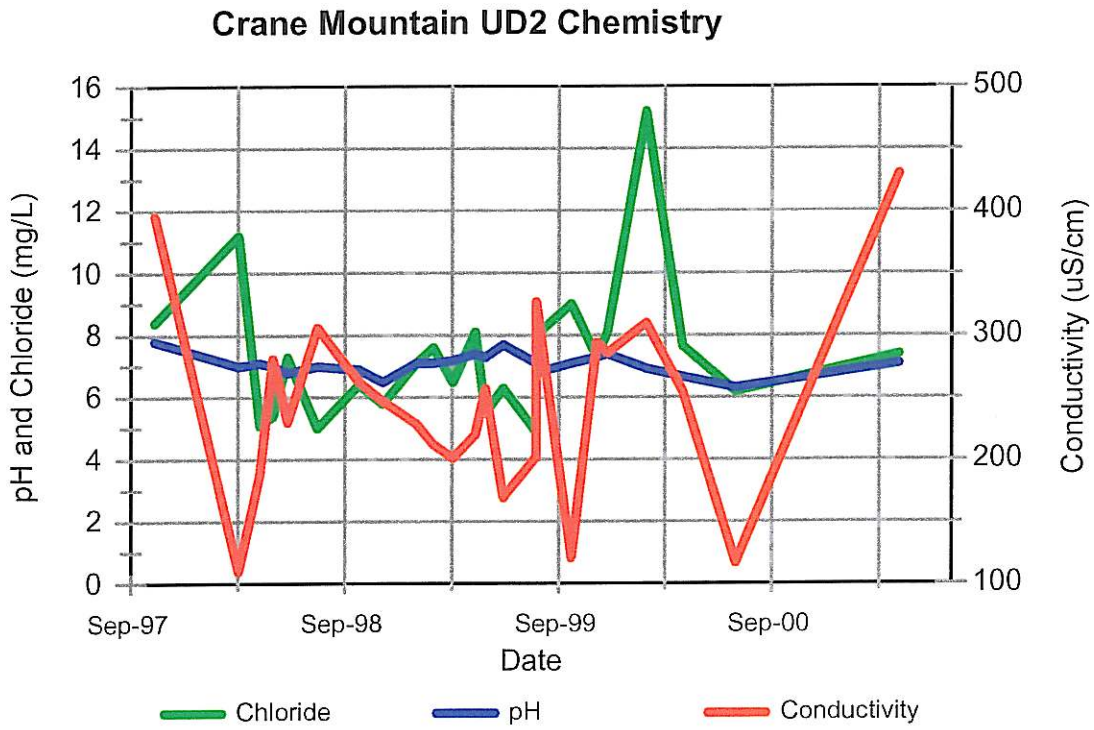
5.16 Adequacy of Emergency Response Plans Relative to Leachate Control

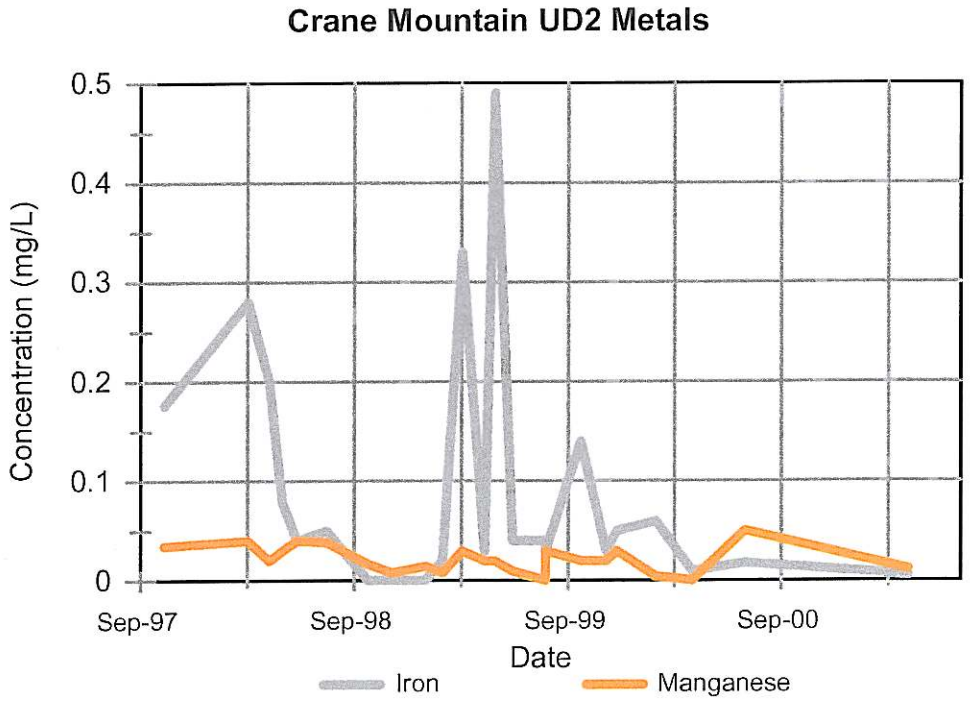
The Emergency Response Plans relative to leachate controls are documented in The August 1, 2000 Emergency Response Procedures, and is a separate one page Contingency Plan: Permeate Discharge. The plans are part of the Approval to Operate requirements; Item 103.

The Contingency Plan: Permeate Discharge applied to the operation of the Zenon leachate treatment system and stated the following:

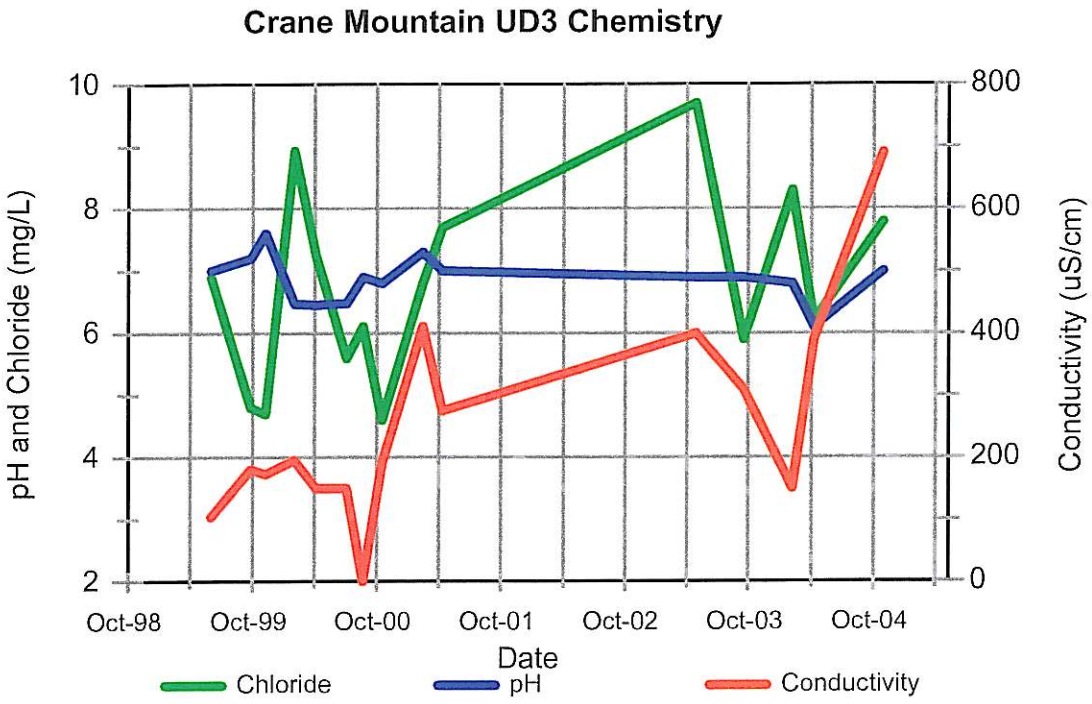
> *In the event that the Discharge Cascade does not work effectively and/or does not meet discharge requirements the following measures would be implemented.*
>
> *Discharge of permeate on-site would cease immediately. The permeate would be trucked to the Lancaster sewage treatment facility in Saint John, while an assessment of the issue with the permeate discharge cascade is being undertaken. Once a satisfactory solution to the situation has been implemented the Commission will seek approval to continue with on-site discharge.*

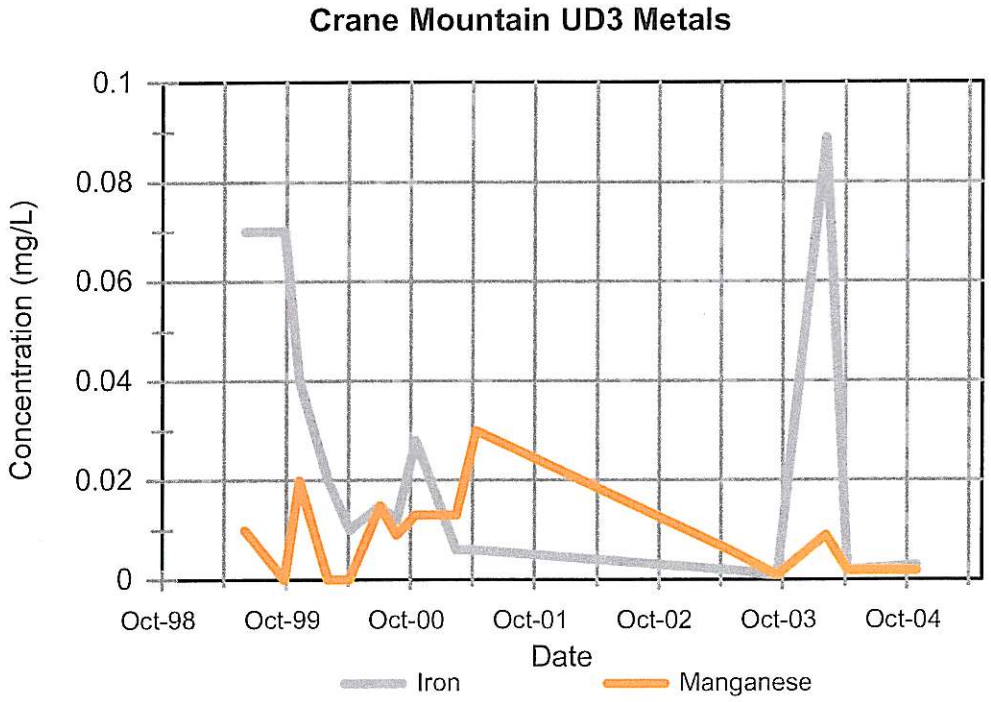
This contingency plan made use of the existing program for leachate disposal that was concurrently operating. It therefore made use of existing equipment and procedures and therefore provided an adequate backup plan. Now that the Zenon plant is shut down, this contingency plan is no longer pertinent.





UD2 Under-Drain Monitoring Results
Figure 5-11





UD3 Under-Drain Monitoring Results
Figure 5-12

The Emergency Response Procedures are a compilation of procedures from Chapter 5 of the 1997 Environmental Management Plan, Section 13.5 of the 1997 Operations Manual, 2003 Fire and Rescue Emergency Plan, complete with Emergency Action Principles and contact phone list. The procedures from the Operations Manual cover fire, explosive gases, spills, lightening, power outages, medical emergencies and vehicular accidents. Under the section on spills, it refers back to the Environmental Management Plan.

The Environmental Management Plan addresses petroleum spills, chemical spills including hazardous liquids and leachate, failure of the sedimentation pond and forest fires. The section on leachate spills addresses on-site and off-site spills and includes notification procedures, response measures for the containment and clean-up of any spills, and reporting requirements. Notification includes the landfill's Environmental Coordinator, the Hazmat (Hazardous Materials) Response Team of the Saint John Fire Department and NBDOELG. Direct notification of the public is not documented in the plan, but would typically be coordinated by the Fire Department.

Overall, the Emergency Response Procedures provide a clear guide for responding to leachate control problems related to spills.

The other aspect of the emergency-type leachate control measures relates to the handling of extreme leachate flows. The landfill currently trucks all leachate to the Lancaster treatment plant. As leachate flows increase, the number of trucks and frequency of truck trips is also increased.

An example of this situation occurred on March 29 to 31, 2003. At that time, leachate flows were very high due to heavy rains and melting snow. Seven tanker trucks hauled leachate continuously for three days. Plans were also in place to pump excess leachate into the empty Cell 3B. Additionally, the clay lined sedimentation pond was emptied to provide extra back-up storage. These options were not used. Since that time, and in response to this event, the FRSWC then constructed the Surge Pond to provide emergency back-up leachate storage capacity.

6.0 REVIEW OF HANDLING AND CONTROL OF ONSITE SURFACE WATER

6.1 Introduction

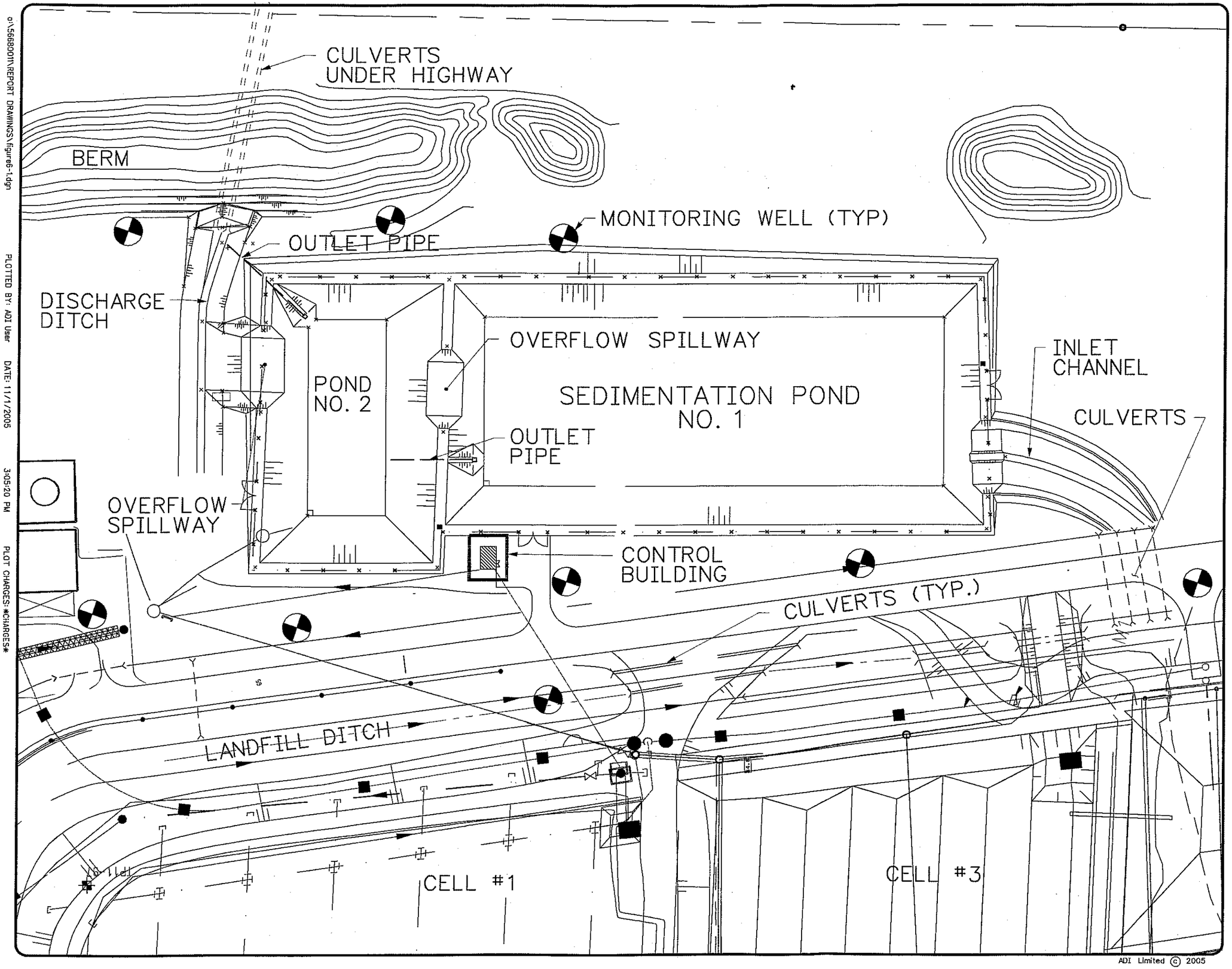
This chapter provides a Review of Handling and Control of Onsite Surface Water, Specification 3.4, which includes the following:

- *Effectiveness of sedimentation ponds in treating and containing surface runoff during normal conditions.*
- *Effectiveness of sedimentation ponds in treating and containing surface water during conditions of heavy or extended precipitation.*
- *Effectiveness of monitoring of surface water runoff.*

The management of on-site surface water at the landfill involves the diversion of clean water away from the landfill, and the collection and possible treatment of water from within the landfill operations areas. The access road around the landfill creates a berm that separates the clean stormwater from the potentially silty stormwater. Most water from outside the roadway berm is diverted around the landfill and into the two creeks on either side of the landfill. They are the Mill Creek to the south and Mellinger Brook to the north.

Drainage from within the existing and future landfill footprint is considered to be potentially silt-laden and therefore must pass through the stormwater sedimentation ponds before discharge to Mellinger Brook. The stormwater treatment system, shown in Figure 6-1, includes two sedimentation ponds and a control building. The stormwater management system were designed to handle a 1 in 100 year storm event.

The surface water is directed to the first and largest pond. The water is contained within this pond until it is ready for discharge to the second pond or the pond overflows. If the water required treatment to reduce the turbidity, then a flocculent is added to enhance the settling of the suspended solids. This is done by drawing water from the north end of the pond, injecting the flocculent, and pumping the water to the south end of the pond. Once the solids settle, the water can be released to the second sedimentation pond and then discharge to the creek.



No.	Revision	Ckd. By	Date

PRELIMINARY

Const. North

Drawn By: OSE

Dwg. Standards Ckd. By:

Designed By: TKO

Date Printed

Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Project Title

INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. Title

STORMWATER MANAGEMENT SYSTEM

Project No.	5668-001.1		
Dwg. No.	FIGURE 6-1	Rev. No.	0
Scale	1:1000		

This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

6.2 Effectiveness of Sedimentation Ponds During Normal Conditions

The effectiveness of the sedimentation ponds in treating and containing surface runoff during normal weather conditions is considered in this section. The performance of the ponds is measured by monitoring the Total Suspended Solids (TSS) level of the discharge from the ponds. The discharge criteria is for a maximum TSS level of 25 mg/L. The following is the monitoring data from 2004.

2004 Sedimentation Ponds Discharge Data

Date	TSS at mid-point of Discharge (mg/L)	FRSWC Comments
May 26, 2004	5	Untreated
September 27, 2004	4.5	Treated with Sternpac
October 29, 2004	1.5	Treated with Sternpac
November 29, 2004	162	See note 1
Note: FRSWC states: Sampled at pond high level overflow, discharge valve is closed. See Dec 2, 2004 letter, product arrived and treatment of pond 1 started on the 30th. It was released on Dec 9th at the direction of DOELG.		

From the 2004 data, it can be seen that sometimes the water in the sedimentation pond is clean enough for direct discharge without any treatment. Other times treatment with the Sternpac flocculent is required prior to discharge.

The December 2, 2004 FRSWC letter indicates that the use of the flocculent in September 2004 was the "first time in almost two years that the sedimentation ponds required treatment prior to release". In general, the stormwater management system operates effectively under normal conditions, where normal conditions refer to average rainfall and standard landfill operations.

Figure 6-2 shows photos of the sedimentation ponds under two different operating conditions. Under normal situations the ponds are clear. Under adverse operating conditions significant siltation can occur, as can be seen in the first sedimentation pond prior to treatment. This occurred during the construction of Cell #4.

Under Normal Conditions June 2004

Under Adverse Conditions May 2005

Aerial Photos of Sedimentation Pond **Figure 6-2**

The November 29, 2004 incident could be considered a heavy precipitation event, as well as a result of construction activities, and is discussed in the next section.

6.3 Effectiveness of Sedimentation Ponds During Conditions of Heavy Precipitation

The effectiveness of the sedimentation ponds under adverse conditions was tested on November 29, 2004. A combination of factors occurred simultaneously resulting in the discharge of silty stormwater with a TSS level of 162 mg/L, compared to the limit of 25 mg/L. The reported factors leading to this problem were, heavy rainfalls in the two weeks prior to the event, ongoing construction of the Surge Pond and Cell 4, and the lack of liquid flocculent on-site at that time.

The 1997 design information states that the sedimentation system was designed for a 1-in-100 year storm event and therefore should be able to handle the heavy rainfall events. The lack of the Sternpac flocculent prevented treatment of the stormwater prior to discharge, or in this case overflow of stormwater. Subsequently the landfill now stores extra dry flocculent on-site so that it is always available.

The other adverse factor was the ongoing construction of the Surge Pond and Cell 4. All the silt-laden runoff from these construction areas has to be routed through the sedimentation ponds to remove the silt. Possibly the system would have been able to reduce the TSS level below 25 mg/L if the flocculent had been available, but perhaps a specific stormwater management plan is warranted for construction activities. This could include the diversion of clean stormwater from stabilized areas of the landfill, as suggested in Environmental Coordinator's December 2, 2004 letter, and ensuring that the sedimentation pond is kept at a low level during construction so that there is a significant buffer capacity for storm events.

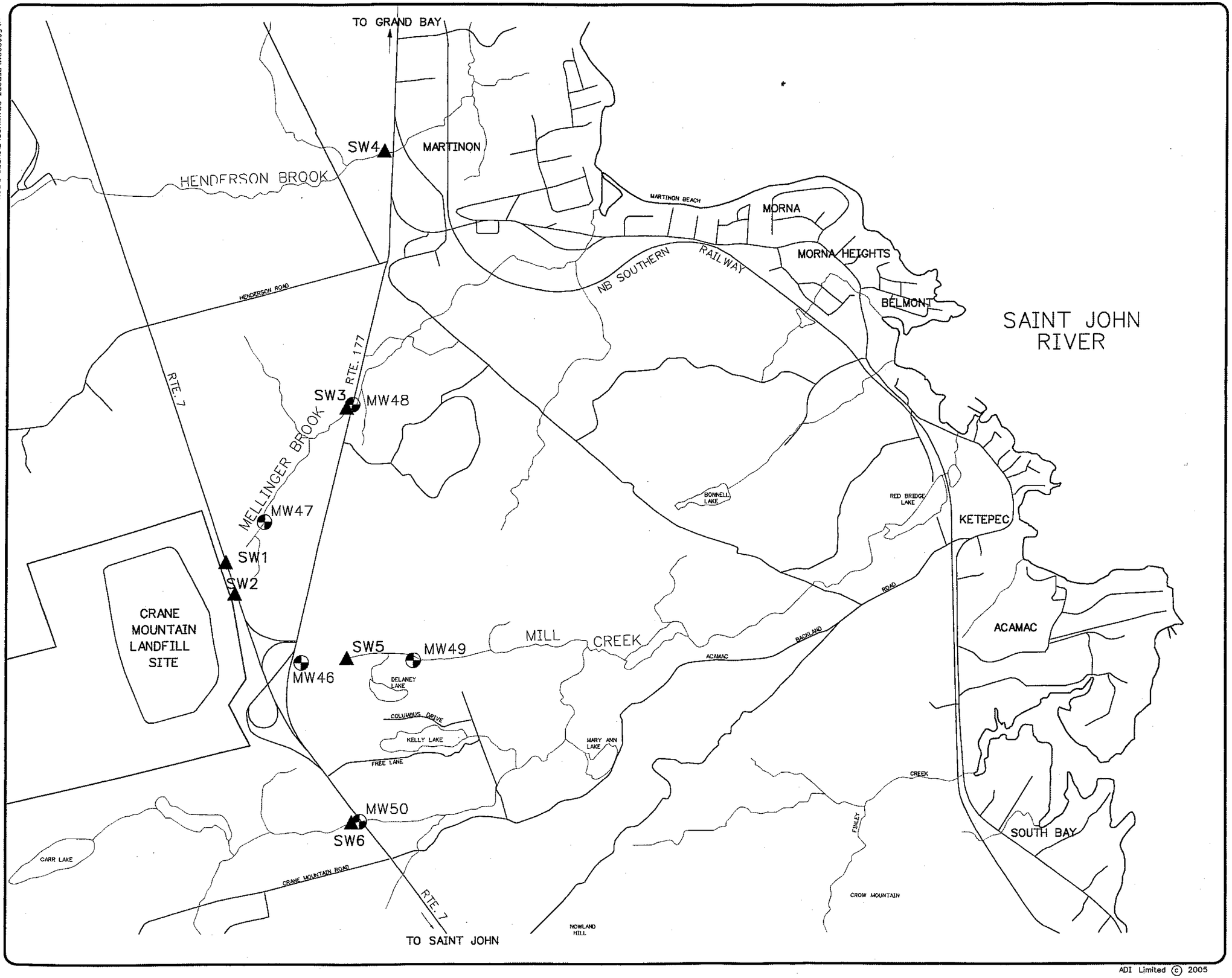
6.4 Effectiveness of Monitoring of Surface Water Runoff

The Approval to Operate requires that each discharge of water from the sedimentation pond is sampled and analyzed for TSS (Item 80). In addition, Item 89 requires surface water sampling at six surface water sites and at the sedimentation pond. The current Approval requires that this sampling be done in April and September every year, and the samples be analyzed for general chemistry (see Item 82 of the Approval to Operate in Appendix A).

The surface water monitoring sites are shown on Figure 6-3. They include one on Henderson Brook in Martinon, three on Mellinger Brook into which the sedimentation pond discharges, and two on the Mill Creek system. Thc frequency of monitoring (two times per year) is considered to be the minimum acceptable. The analytical suite is considered adequate, and screens for a number of typical landfill leachate impact indicator parameters (e.g. chloride, conductivity, ammonia).

The current surface water monitoring program is considered adequate in terms of sampling locations and analytical suite. However, regarding water quality sampling frequency, a data gap was noted in the information provided (no results for 2002). Such a gaps should be avoided. It is suggested that trend plots of key leachate impact indicator parameters (e.g. chloride, conductivity) be maintained as part of the ongoing monitoring review and interpretation process.

It is noted that ACAP Saint John conducts additional independent water quality monitoring on Mill Creek and Mellinger Brook. Their program involves sampling during thc summer monthes of June thru August. The data for Mellinger Brook indicated high turbidity in August 1998. This coincided with the construction of Cell #2. Since that time the turbidity and conductivity levels have remained low except for some slightly higher values in 2001. The results for Mill Creek indicate generally good water quality.



SW4 ▲ SURFACE WATER MONITORING SITE

MW46 ⊕ OFF-SITE GROUNDWATER MONITORING WELLS

No.	Revision	Ckd. By	Date

PRELIMINARY

Const. North

Drawn By: OSE

Dwg. Standards Ckd. By:

Designed By: TKO

Date Printed

Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Project Title

INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. Title

SURFACE WATER MONITORING SITES

Project No.	5668-001.1		
Dwg. No.	FIGURE 6-3	Rev. No.	0
Scale	1:20000		

This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney Port Hawkesbury, St.John's, Fredericton and Salem, NH

7.0 REVIEW OF HANDLING/DISPOSAL OF HAZARDOUS WASTES

7.1 Introduction

This chapter provides a review of the current handling and disposal methods associated with hazardous wastes at the landfill, Specification 3.5, which states:

- *Methods of identification and control of industrial and household hazardous wastes.*

7.2 Methods of Identification and Control of Hazardous Wastes

Hazardous wastes including industrial waste and household hazardous waste (HHW), are generally not accepted for disposal at the landfill, except for asbestos and limited quantities of HHW. The landfill employs spotters at both the municipal landfill, and the construction and demolition debris site. They monitor the disposal of the waste. FRSWC defines and lists acceptable and unacceptable wastes. They also provide on their website reference/links to the household hazardous wastes alternatives.

The C&D disposal site is not lined and therefore identification and separation of hazardous wastes is imperative. The spotter at the site has been observed to be very diligent in monitoring all loads received. This even in some cases includes assisting the public in unloading materials so that the spotter can monitor all debris material. If waste is not acceptable, then people are directed to the landfill's drop-off bin. For commercial users, if unacceptable waste is found, then their entire load is directed to the landfill face and they are charged the much higher fee for disposal.

The spotter at the municipal landfill face monitors loads dumped at that location. At this location is harder to monitor and control all the material. For example, very little can be seen in the large loads from the municipal garbage trucks.

Since all the waste cannot be inspected, some hazardous materials may end up at the site. As observed on a visit to the landfill, car batteries end up at the site. These were identified by the spotter and separated for later removal from the site. It is also noted that residential drop-off bins are not monitored. An option to help reduce the likelihood of hazardous wastes ending up in the landfill is to implement a community-based HHW program and to construct a HHW drop-off facility at the landfill.

8.0 REVIEW OF WASTE DIVERSION

8.1 Introduction

The review of waste diversion, Specification 3.6, relates to both the FRSWC and activities at the landfill, including the following:

- *Methods used.*
- *Rate of diversion.*

Waste diversion is primarily a function of the FRSWC rather than a specific landfill function. As such, most of the implementation of waste diversion is directed and coordinated by the Commission. This includes the regional Blue Bin program and compost material collection. Through the landfill staff, educational initiatives are implemented to assist in promoting waste diversion. The landfill staff also weigh and document the various waste and recyclable materials.

This chapter provides a review of the items associated with Waste Diversion.

8.2 Diversion Methods Used

The diversion of waste out of the engineered landfill is a goal of the FRSWC, the community and the Province. There are several programs for this purpose.

The curbside compost pickup program provides a means for residents to separate their organic home and garden wastes. These wastes are picked up separately from garbage and hauled to the landfill's compost facility for processing. In 2004 about 7,250 tonnes of compostable material was diverted out of the landfill.

The community recycling program includes 23 blue bin recycling depots throughout the region. These allow the public to recycle paper, cardboard, metal, and plastics. In 2004 recycled material totalled 5,150 tonnes.

Other means of recycling which are available at the landfill include tires, metal and cardboard. Within the community there are also the Redemption Depots for beverage container recycling. Some business utilize private firms for the recycling of office paper products.

A major part of the diversion of waste out of the landfill cells is the separate disposal site for the construction and demolition waste at the C&D disposal site at the landfill. The benefit of the this program is that this material is not disposed of in the more expensive engineered landfill cells. C&D waste uses up more landfill volume than normal municipal waste and therefore can reduce the lifespan of the landfill. In 2004 about 9,470 tonnes of C&D waste was diverted out of the landfill cells and disposed of in the C&D disposal site.

8.3 Rate of Diversion

The following table summarizes the waste quantities from the landfill for 2004.

2004 Waste Tonnages

2004 Tonnes	MSW	C & D	Compost	Tires	Asbestos	Special	Blue Bins	Total
City of Saint John	11,409	317	2,659	3.4			2,800	17,189
Town of Grand Bay	16	18						34
Town of Hampton	857		216				359	1,432
Town of Rothesay	2,269		910	0.4			1,409	4,588
Village of St. Martins	144						59	203
Local Service Dist's	3,886	12	637	0.6			152	4,688
Cash	3,357	3,953	165	1.8			370	7,847
Other	44,958	5,174	2,659	39.1	679.5	5.82		53,516
TOTAL:	**66,896**	**9,475**	**7,245**	**45.3**	**679.5**	**5.82**	**5,149**	**89,496**
Residential	21,938		7,245	6.2			5,149	34,339
ICI (1)	44,958	9,475		39.1	679.5	5.82		55,158
TOTAL:	**66,896**	**9,475**	**7,245**	**45.3**	**679.5**	**5.82**	**5,149**	**89,496**
(1) ICI figures also include Quispamsis & Grand Bay.								

From this data it is noted that approximately two thirds of the MSW comes from the ICI sector (industrial, commercial, institutional).

The calculation of a diversion rate depends on many variables and what particular component of the waste stream is being considered, such as industrial, commercial, residential or all sources. To calculate an accurate diversion rate all the sources of waste need to be measured. For this study we only have the data presented which relates to only those materials that are weighed at the landfill.

From the given data, diversion rates can be calculated for a variety of parameters including:

- Diversion rate out of the landfill cells compared to Total Waste received at the landfill:

  (C&D + compost + tires + recycling) / (Total Waste) = 24.5%

- Diversion rate out of the landfill cells compared to the total Residential Waste received at the landfill:

  (Compost + residential tires + recycling) / (Total Residential Waste) = 36.1 %

A 1996 letter to the FRSWC regarding Clarification of Order in Council (96-849) Condition (e), defined a waste diversion objective of 35,000 tonnes of waste per year. This was to be diverted from the landfill cells and was to use 1996 as the baseline year for comparison. In 2004 the amount of waste (measured at the landfill) diverted from the cells was about 22,000 tonnes. This falls short of the stated objective. It is noted that to accurately determine this number a comparison would have to be made to the 1996 waste generation rates and contributing population.

As a possible means of increasing the diversion rate, consideration could be given to providing a blue bin recycling facility at the landfill. This facility, combined with a HHW drop-off facility and the existing waste disposal bin, would allow the public to sort and appropriately dispose of their waste at one location.

9.0 REVIEW OF DAILY OPERATIONS

9.1 Introduction

The Review of Daily Operations, Specification 3.7, includes the following:

- *Daily cover.*
- *Quality control of acceptable and unacceptable waste.*
- *Pest and bird control.*

9.2 Daily Cover

Daily cover material is placed over the waste at the active face of the landfill. This is done at the end of each day. The daily cover helps to contain the waste and reduce animal access to the waste. Generally daily cover material is not a low permeability material. It is preferred that water can seep through the cover material instead of ponding on each layer.

A minimum layer of 150 mm of material is required for daily cover. The FRSWC contracts out the supply of daily cover. The material is imported to the site, with each load being weighed. The operation of the landfill and the use of daily cover meet the current standards.

9.3 Quality Control of Acceptable and Unacceptable Waste

The quality control of acceptable and unacceptable waste is similar to some of the issues associated with hazardous wastes and recycling. The Approval in Item 29 specifies that supervision is to be provided at the landfill and that incoming waste is to be routinely scrutinized. Item 43 for the Construction and Demolition site, specifies that all incoming C&D debris be scrutinized, and that any unacceptable materials immediately be removed and disposed of at an approved location. Both of these conditions are been satisfied at C&D site and the landfill active face.

Improved control of the waste disposed of at the residential waste disposal bin may be warranted. If a HHW and recycling facility were located at the same location as the bins, then there would be a greater opportunity for the public to separate unacceptable wastes from acceptable wastes.

9.4 Bird and Pest Control

The control of birds and rodents is an ongoing process at any landfill. Landfilling practices at the active face can be tailored to reduce access to the waste. This is done through compaction of the waste, having a small active face and using daily cover.

For bird control, these measures are supplemented by the use of noise to scare the birds away from the landfill. In general it is reported that rodents are not a major problem at the landfill. If rodents are observed, then a baiting program is implemented in accordance with the requirements of the Approval to Operate, Schedule "D", Pest Control at NB Landfill Sites and Transfer Stations.

10.0 GENERAL REVIEW OF MONITORING/CONTROL OF LANDFILL GAS

10.1 Introduction

This chapter includes a general Review of Monitoring/Control of Landfill Gas, (Specification 3.8):

- *Effect of uncapped cells on landfill gas production.*
- *Monitoring/control of concentration and migration of methane, carbon dioxide, non-methane organic compounds (NMOCs).*
- *Monitoring/control of lateral migration of landfill gas.*
- *Monitoring/control of airborne particulate and odour.*

The scope of work for the review of landfill gas monitoring and control systems has been limited to a general overview of the issues.

10.2 Effect of Uncapped Cells on Landfill Gas Production

Landfill gas is generated as organic waste decomposes under anaerobic conditions (without oxygen) within the landfill. The rate of gas production is influenced by the amount of water that seeps into the landfill and hence is effected by whether the landfill is capped or not. Landfill gas is presently vented through vent pipes at the top of the capped slopes of Cell #1 and #2. It is also passively vented through the uncapped top of the landfill. Figure 10-1 includes aerial photos of the landfill in which the capped areas can be seen on the landfill slopes.

The passive gas collection and venting piping system incorporates collection piping in the granular layer under the clay cap, and includes the following:

- 100 mm diameter SDR 26 perforated gas footer pipe along the base of the slope.
- 100 mm perforated gas vent pipes spaced about 40 m apart and extending from the footer pipe to the top of the slope and running up through the stone gas venting layer.

June 2004

May 2005

Aerial Photos of Capped and Active Landfill Figure 10-1

- 100 mm perforated gas header pipe at the top of the slope and by the drainage swale. This pipe connects to each vent pipe running up the slope.

- 100 mm diameter solid vent pipes extending 1.0 m above the landfill to vent the gas to the atmosphere. There are fourteen gas vents.

The gas venting system is a passive system, meaning that it is not assisted by any mechanical means like fans or compressors. There is the potential to connect the system in the future to a mechanical system where a vacuum pressure would be put on the system to draw the gas out of the landfill.

By not capping the completed landfill cells, the landfill gas production rate is increased until the cell is capped. Following capping, landfill gas will continue to be generated, but at a slower rate.

10.3 Monitoring/Control of Concentration and Migration of Landfill Gas

Landfill gas is composed mostly of methane and carbon dioxide. It also contains non-methane organic compounds (NMOC's) which includes hydrogen sulfide, sulfites, and other compounds. At present, the landfill gas is not monitored.

The Approval to Operate calls for a high volume air quality sampling station for use during construction (Item 69). This was reportedly installed and operated during the initial operation of the landfill, but has since been removed. This was based on the lack of data (low or no readings) recorded at the site. To comply with the Approval, it is suggested that the station be put into operation during subsequent construction activities.

10.4 Monitoring/Control of Lateral Migration of Landfill Gas

Landfill gas can migrate laterally from a landfill into the surrounding soils. This is a problem more associated with older landfills that did not have synthetic liner systems. At the Crane Mountain Landfill, the HDPE cell liner will prevent lateral off-site gas migration in the lower portion of the landfill. Above the liner, at the perimeter berms, the landfill has been built up above the surrounding land. Therefore lateral gas migration will be contained

at the landfill cell perimeter and vented to the atmosphere rather than into the surrounding soils.

10.5 Monitoring/Control of Airborne Particulate and Odour

Odour from the landfill is evident around the site including along the highway. The odour could be from a combination of landfill gas and vapours from the active face. The difference is the landfill gas is from decomposing wastes, while odour from the active face is directly from fresh garbage. Landfill gas odours can be reduced by capping the landfill to reduce the rate of landfill gas generation. It can be further reduced through collecting and flaring the landfill gas, whereby odourous compounds are converted to a non or reduced odourous state. For example, flaring would convert hydrogen sulfide, a poisonous and rotten egg smelling gas, from H_2S to lower odour sulfur dioxide SO_2.

The Federal Government has endorsed the Kyoto Accord and is therefore encouraging the reduction in greenhouse gas (GHG) emissions. Landfills are a major source of GHGs, particularly methane. Methane is about 20 times more reactive than carbon dioxide and therefore reducing methane emissions from the landfill can have a significant environmental benefit. It is understood that a proposal has been submitted to the government for funding for a gas collection system, with possible utilization at the compost facility. This is an important step that should be implemented.

It is noted that the NBDELG has indicated in a letter on December 10, 2004 regarding raising the height of the landfill, that the "Department has no plans to establish landfill gas management guidelines". Despite this, it is recommended that in the context of local odour control and the Federal government's objective of reducing greenhouse gases, that the FRSWC proceed with a landfill gas system.

11.0 REVIEW OF ISSUES RELATED TO DOMESTIC WELLS

11.1 Introduction

FFEBC requested that ADI review selected issues related to the domestic well monitoring program at the landfill site. The scope of the investigation included an assessment of the following issues:

- Number and location of the wells currently monitored;
- Monitoring frequency;
- Suite of analytical parameters included in the monitoring program; and,
- Adequacy of the emergency response plans relative to domestic well contamination.

In addition to the above, FFEBC requested that ADI comment on database management system(s) whereby the results of the domestic well monitoring program can be traced in a more meaningful manner.

FFEBC provided ADI with some limited domestic well monitoring results as part of the current project.

General considerations and each of the above noted issues are discussed in the following sections.

11.2 General Considerations

Although the exact number is unknown it is estimated that close to one thousand domestic water supply wells are located downgradient of the landfill. The area is primarily underlain by igneous rock types (granite, granodiorite, quartz diorite, etc.) with localized areas of sandstone and conglomerate. Domestic wells would be expected to be almost exclusively completed in bedrock. Groundwater flow in the bedrock is controlled by flow through a network of rock fractures. Overburden soil in the area is comprised of a veneer of loamy lodgement till, minor ablation till, silt, sand, gravel and rubble (Rampton et al., 1984). Overlying the above soil is a thin, discontinuous veneer of sand, some gravel and silt and rare clay. Where present, the thickness of this material is generally less than 0.5 m. The thickness of the till overburden generally increases moving southwest towards the landfill site.

The New Brunswick Department of the Environment and Local Government (NBDELG) has maintained a database of domestic water well information for many wells constructed in the province in recent years. A request was submitted to NBDELG to provide available water well records from this database within the study area to provide some background information on private water supply wells in the area. Water well records were subsequently provided for a total of twenty-one wells in the study area. Well depths and estimated yields ranged from 18 m to 128 m with an average of 74 m, and 0 m^3/day (0 Igpm) to 66 m^3/day (10 Igpm) with an average of 18 m^3/day (2.7 Igpm), respectively. Reported depth to bedrock ranged from 0 m to 59 m with an average of 6 m.

11.3 Number and Location of Wells

It is our understanding that there are currently approximately forty-five (45) participants in the domestic well monitoring program. The identities of the participants in the monitoring program and hence the exact locations of their respective wells could not be obtained for the purpose of completing the current assessment due to privacy legislation considerations. The locations of the domestic wells included in the monitoring program were determined by whoever volunteered to take part in this program. Therefore, the locations of wells are somewhat spread out and extend from Martinon to South Bay as shown on a drawing (Figure 6-1) of the surface water and groundwater monitoring sites included in the Environmental Management Plan. Although most of the wells shown on the above noted figure are located in the general downgradient direction of the landfill, it is noted that a few wells are located across gradient of the site (e.g. wells in the South Bay area). It is not known how many of these outlying wells are included in the current monitoring program.

It is estimated that there are on the order of one thousand (wells) domestic wells situated downgradient of the landfill site. Therefore, about five percent of these wells are currently included in the monitoring program. Consideration should be given to increasing the number of wells in the monitoring program to provide for a more representative indication of the quality of the quality of domestic groundwater supplies. However, it is acknowledged that adding to the program will be contingent upon finding new volunteers. Any new wells should be positioned east-northeast of the landfill in the general downgradient location.

The number of wells included in the monitoring program has decreased from sixty-five (65) to forty-five (45). Well owners included in the monitoring program have the option of not continuing with the program is they so wish. It is suggested that in order to maintain a large

representative sample, that participants be encouraged to continue their participation in the monitoring program.

11.4 Monitoring Frequency

It is understood that the domestic wells included in the domestic well monitoring program are currently sampled once per year in September/October under the current Approval to Operate to operate the landfill issued by NBDELG. Ideally, long term groundwater monitoring programs should include low flow (i.e. summer or winter) and high flow (i.e. spring or fall) bi-annual sampling events as a minimum to assess the effect of the groundwater recharge cycle on water quality.

11.5 Suite of Analytical Parameters

The current Approval requires that domestic wells be analyzed for general chemistry parameters. It is understood that the analytical suite has been reduced in recent years. Based upon a review of the limited domestic well monitoring results provided for the current study, trace metals and microbiological parameters including coliforms and E. coli were included in the analytical suite at least as late as 1997 and 1998, respectively.

As a minimum, any landfill water quality monitoring program should include leachate indicator parameters. For municipal solid waste landfills such as the Crane Mountain facility, key leachate indicator parameters are expected to include alkalinity, iron, manganese, conductivity, pH, sodium, chloride and ammonia-N. All of these parameters are included in the general chemistry analytical suite and, therefore, the current parameters included in the analytical suite are considered to be acceptable.

11.6 Emergency Response Plans

The Environmental Management Plan (EMP) for the Crane Mountain facility outlines remedial measures which may be taken in the event that "trigger" concentrations are exceeded for key parameters in the groundwater monitoring data or the domestic well water quality data. The "trigger" concentrations are not defined and it is stated in the EMP that they will be established based on an analysis of background water quality data. Remedial

action will only be taken if the results of a more detailed analysis on the water quality data indicate that the trigger exceedances are not related to natural background variation.

Suggested remedial options in the event of the identification of parameter concentrations in domestic well water in excess of "trigger" concentrations include developing alternate water supplies and treating the affected water. As previously mentioned in this report, although these conceptual remedial approaches are probably acceptable for the purpose of the Environmental Management Plan, they are vague. Hence, it is recommended that "trigger" concentrations for key indicator parameters in domestic wells be developed.

11.7 Database Management System

Overview

Currently, the results are tabulated for comparison with the Guidelines for the Protection of Canadian Drinking Water Quality (GPCDWQ) established by Health Canada or the New Brunswick Health Advisory Limits (HAL's). Analytical results are forwarded to respective homeowners and parameters with concentrations in excess of guideline values are flagged for reference. FFEBC has requested that ADI comment on a possible framework for a database management system whereby the results of the domestic well monitoring program can be traced in a more meaningful manner.

There are several potential approaches whereby the water quality database could be better managed to assist in the identification of potential leachate impacts. One of the challenges associated with the interpretation of the data is the need to separate natural background variation in parameter concentrations from trends which may be indicative of leachate impacts. Two methods for consideration to assist in better management of the domestic water well database are discussed in this report: 1) preparation of major ion chemistry plots (e.g. Piper trilinear plots), and 2) implementation of ASTM D6312-98 (2005) (Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs). The latter method is discussed since it is referenced as a potential method to distinguish between natural background variation and landfill impacts in the EMP. Each of these approaches are discussed in the following sections.

Major Ion Chemistry Plots

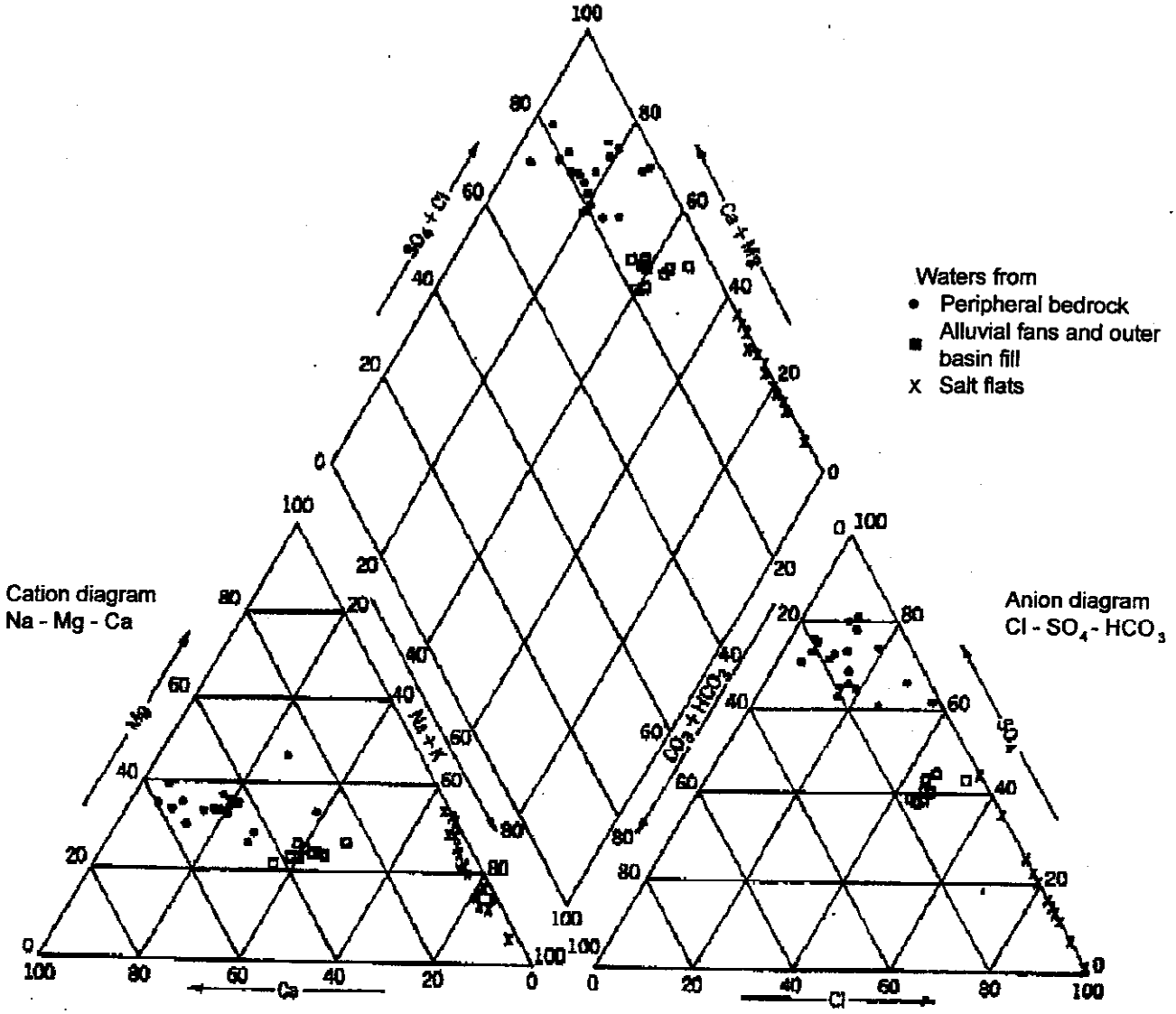
Major ion chemistry plots provide a relatively simple and convenient means to isolate water of similar chemical "types" and thereby effectively remove some of the background variation. This method can also assist in tracking the geochemical evolution of groundwater as it passes through the flow system. An example of one such plot is the Piper trilinear plot (Figures 11-1 and 11-2).

Piper trilinear plots (as well as other major ion chemistry plots) could be prepared for the wells included in the monitoring program to allow the groundwater from the database wells to be broken down into different geochemical classes or chemical "types". Basic statistical (arithmetic mean and variance) parameters could then be calculated for the leachate indicator parameter identified above for each chemical type of water. Target or "trigger" levels as discussed in the Crane Mountain EMP could then be developed for these parameters.

The use of major ion chemistry plots such as Piper trilinear diagrams can be subject to some limitations. Since chemical composition is represented as a percentage, waters of very different total concentrations can show identical representation on the diagram. Therefore, it is important that the statistical parameters discussed above be computed for the main water types. Furthermore, organic parameters and several inorganic parameters of interest are not portrayed on the diagram. Notwithstanding these limitations, the development of Piper trilinear plots from the domestic well database is considered to be a good database management tool if this tool is used to augment the overall review of the water quality results by a qualified individual (e.g. hydrogeologist or environmental engineer with hydrogeological training).

Rigorous Statistical Database Management

A more rigorous statistical approach to the management of the domestic water well database would be to follow the procedures outlined in ASTM D6312-98 (2005) - Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs. This ASTM standard, which was formerly known as ASTM PS64-96, is referenced in the EMP as a possible tool to distinguish between potential landfill sourced impacts and natural background variation in the event that parameter concentrations in excess of the "trigger" levels are encountered in the domestic water well database. An overview of the process is provided below.



(a) EXAMPLE OF PIPER TRILINEAR DIAGRAM

FOR INFORMATION ONLY

This drawing is not to be scaled

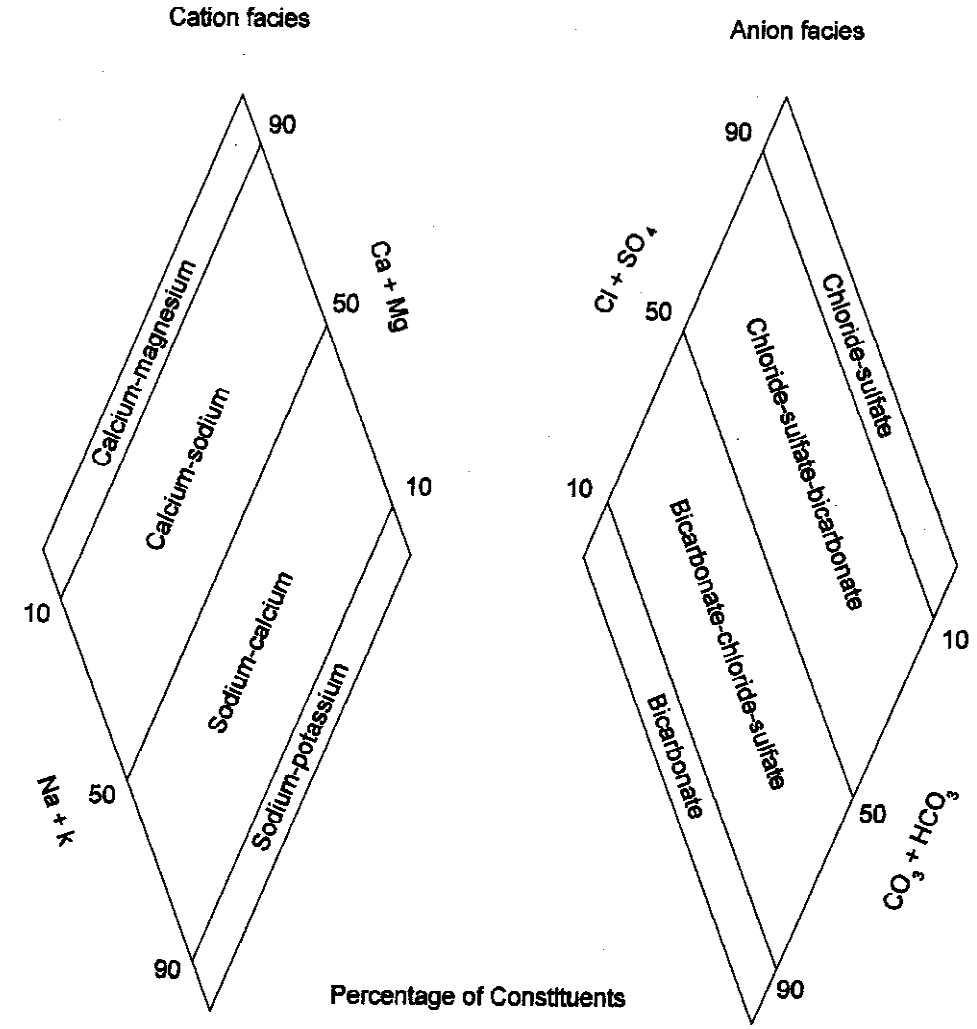
ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj. INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. PIPER TRILINEAR DIAGRAM

Drawn By: J.D.M.	Proj. No. 5668-001.1
Dwg. Standards Chk. By:	Dwg. No. FIGURE 11-1
Designed By: R:G	Dwg. Design Chk. By: / Rev. 0



(b) TEMPLATES FOR CLASSIFYING WATERS
(CATIONS AND ANIONS)
(AFTER DOMENICO & SCHWARTZ, 1990)

FOR INFORMATION ONLY

This drawing is not to be scaled

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

Proj.	INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL
Dwg.	PIPER TRILINEAR DIAGRAM

Drawn By: J.D.M.	Proj. No. 5668-001.1	
Dwg. Standards Chk. By:	Dwg. No. FIGURE 11-2	
Designed By: R.G	Dwg. Design Chk. By:	Rev. 0

The purpose of the ASTM standard is to assist in the development of a groundwater monitoring standard that minimizes both false negative (failure to detect contamination when it is present) and false positive rates (conclusion of the presence of contamination when there is none) without sacrificing one for the other. A flowchart is provided in the standard that illustrates the steps in developing a statistical monitoring plan which is based on either upgradient versus downgradient well comparisons, intra-well comparisons or a combination of both. Intra-well comparisons are preferred over inter-well comparisons since the former completely eliminates the spatial component of variability. The statistical methods include parametric and non-parametric prediction limits for background versus monitoring well comparisons and combined Shewart-CUSUM control charts for intra-well comparisons.

The chief limitation of the above described method is its complexity. To implement this method, an interdisciplinary site-specific study would be required by individuals ideally possessing training and experience in advanced statistical analysis in addition to hydrogeology and environmental engineering. It also should be noted that it is possible that the existing domestic well monitoring network and associated water quality database are not suitable for the implementation of ASTM D6312-98 (2005).

Implementation

It is recommended that major ion chemistry plots (e.g. Piper trilinear plots) be prepared for the wells included in the monitoring program to allow the groundwater from the database wells to be broken down into different chemical "types". Basic statistical (arithmetic mean and variance) parameters should then be calculated for the leachate indicator parameter identified above for each chemical type of water. Target or "trigger" levels as discussed in the Crane Mountain EMP should then be developed for these parameters. In addition to the above, the monitoring data should initially be reviewed on an annual basis by a qualified individual. The frequency of the data review can be adjusted at a later date based on the findings of the initial reviews.

It should be noted that landfill impacts to groundwater quality cannot be definitively determined from a statistical analysis alone. A statistically significant exceedance over background levels simply indicates a measurement which is inconsistent with chance expectations based upon the available sample of background measurements. Similarly, statistical measurements cannot overcome potential limitations such as poor site characterization, inadequate well locations, non-representative analytical suite of parameters and other issues.

Establishing a database management system for the domestic well monitoring results would be a beneficial tool for FFEBC. This information could become a further level of monitoring of groundwater quality, and a tool in the implementation of an emergency response plan.

12.0 SUMMARY AND RECOMMENDATIONS

12.1 Introduction

This chapter provides a summary of the Independent External Review,a and presents recommendations for improving the Crane Mountain Landfill.

12.2 Summary of Review

The findings of the Independent External Review of Crane Mountain Landfill are summarized in the following table. Summary comments are provided for each specification of the review. The Request For Proposals called for highlighting real or potential areas of concern, if any, and proposals for remedial measures. These are included in the summary. Some comments indicate that a particular item "appears adequate". Such an assessment is based on the information available for the study, which may not have been complete.

Summary of Review

Specifications		Comments
Review of Approvals to Operate	*Assessment of the Fundy Region Solid Waste Commission's compliance with Approvals to Operate*	In general the FRSWC operates the landfill in compliance with the Approval, including design, monitoring and reporting. Amendments should be considered relative to leachate treatment and disposal. An air quality sampling station should be considered during construction activities. Improved analysis of monitoring data is recommended.
	Assessment of adequacy of the Approvals to Operate in providing protection for domestic wells and streams in "host community" down gradient of landfill.	The design of the landfill meets current Approval requirements. Improvements that lower the operating level of the leachate level within the landfill cells should be implemented to better protect the groundwater. A double liner system should be considered for future cells.
Review of Monitoring Wells Surrounding the Landfill	*Adequacy of location, design, and number of onsite monitoring wells, given the hydrogeological characteristics of the site.*	Adequate. Consideration to installing deeper bedrock wells should be given to assist in further addressing characterization of the flow system and fracture network. Improve management of the monitoring program in the context of down gradient domestic well users.

Specifications		Comments
	Analytical database of monitoring well data.	Adequate.
	Adequacy of background data with respect to scope and variability.	Adequate.
	Identification of analytical anomalies with particular attention to leachate indicator parameters.	Further work required. Trigger parameters and levels referenced in EMP should be defined. Site warrants more detailed level of interpretation and reporting in the context of location in upstream end of drainage basin with large number of domestic supply wells located downgradient of site.
	Adequacy of sampling and testing: quality control, frequency, and scope.	Adequate.
	Adequacy of analysis of data from testing.	Further work required. Trigger parameters and levels referenced in EMP should be defined. Site warrants more detailed level of interpretation and reporting in the context of location in upstream end of drainage basin with large number of domestic supply wells located downgradient of site.
	Adequacy of emergency response plans relative to findings in onsite monitoring wells.	General framework is adequate. More work should be completed in terms of practical implementation (e.g. trigger parameters and levels referenced in EMP require definition).
Review of Handling and Control of Leachate	*Effect of uncapped cells on leachate quantity and quality.*	The uncapped cells mean increased leachate generation rates. It is suggested that additional portions of Cells #1 and #2, and portions of Cell #3 receive final closure. A strategy of progressive closure should be implemented.
	Effect of raising height of cells on integrity of clay and synthetic liners.	Raising the height of the landfill does not appear to adversely affect the liner systems beyond their design capacity, particularly since there are no pipe penetrations through the liner.

Specifications		Comments
	Adequacy of material used for cell-capping.	The landfill cover system used to cap the sideslopes of Cells #1 and #2 appears to adhere to the Approval.
	Permeability/ advective breakthrough time of clay liner, under field conditions, relative to recorded heights of leachate in cells (based on studies of three sources of materials tested).	Appears adequate if typical municipal design head of 0.3 m is maintained. *Relative to recorded heights of leachate in cells, further clarification of documentation provided on breakthrough time is warranted.* Breakthrough time should be revisited in context of proposed ponding of leachate in cell, and the fact that existing data suggests during operation there have been prolonged periods wherein leachate head is higher than the 0.3 m typically used in landfill design.
	Effect on clay and synthetic liners of using cells as holding ponds.	It is recommended that the leachate levels be maintained at a lower level. It is suggested that leachate be automatically pumped to the Surge Pond and that a double liner system be used.
	Pre-treatment of leachate before disposal.	Since the Zenon treatment plant closed there is not pre-treatment of leachate prior to trucking it to the Lancaster treatment facility. The FRSWC is in negotiations with the City of Saint John to establish an agreement for the long-term discharge of leachate to the Lancaster Facility. An option that could be considered in conjunction with using the Surge Pond to lower leachate levels in the cells, would be to add aeration to the Surge Pond for pre-treatment.
	Assessment of interaction between groundwater and surface water.	The removal of water as leachate, out of the groundwater system is expected to have a nominal impact on the hydrology of the landfill watershed.
	Surge pond: Integrity of clay liner and synthetic liner, using projected depth of stored leachate.	The present operation of the Surge Pond involves only temporary use of the facility. Therefore the increased depth of leachate on the liner is not expected to cause a problem.
	Identification of chemical composition of leachate.	The leachate composition is regularly monitored and documented. Over time, the BOD concentration has dropped to very low levels for a landfill. In 2004 the average was 140 mg/L. This is partly due to the diversion of organics waste to the composting facility.

Specifications		Comments
	Adequacy of sampling and analysis of sampling of under-drain layer.	The underdrain sampling frequency seems adequate, but the analysis of the data is inadequate.
	Adequacy of emergency response plans relative to leachate control.	The leachate control emergency response plans appear adequate.
Review of Handling and Control of Onsite Surface Water	*Effectiveness of sedimentation ponds in treating and containing surface runoff during normal conditions.*	The available monitoring data indicates that under normal rainfall and operating conditions, the sedimentation ponds can effectively treat the surface runoff.
	Effectiveness of sedimentation ponds in treating and containing surface water during conditions of heavy or extended precipitation.	Under adverse conditions, the system may not be able to adequately treat the surface water. This occurred in Nov. 2004 during heavy rains, lack of flocculent and during construction projects. Improvements have been made to reduce the risk. It is recommended that a specific stormwater management plan be established for construction projects.
	Effectiveness of monitoring of surface water runoff.	The available data indicated a data gap in 2002. Monitoring should be completed in accordance with the schedule in the Approval, and the monitoring data should be analysed for trends in key leachate indicator parameters.
Review of Handling/Disposal of Hazardous Wastes	*Methods of identification and control of industrial and household hazardous wastes.*	Adequate monitoring of waste materials appears to be conducted on-site at the landfill active face and at the C&D site. It is recommended that a HHW drop-off facility be provided at the landfill to assist the public in separating hazardous wastes from municipal waste. It should be located beside the residential drop-off bin/ transfer station.
Review of Waste Diversion	*Methods used.*	Waste is diverted out of the engineered landfill cells through composting, recycling and the separate C&D debris disposal site. Additional waste is diverted privately through commercial paper recycling.

Specifications		Comments
	Rate of diversion.	The rate of diversion can be calculated several different ways. Using only the 2004 data from the landfill scale, the diversion including ICI material was about 25% and the residential diversion rate was about 36%. An on-site blue bin recycling depot is recommended.
Review of Daily Operations	*Daily cover.*	Appears adequate.
	Quality control of acceptable and unacceptable waste.	Monitoring of waste at the C&D site appears to be very good. It is more difficult at the landfill active face, so better opportunities for the public to sort their HHW would help to reduce unacceptable waste going to the landfill.
	Pest and bird control.	Appears adequate.
General Review of Monitoring/Control of Landfill Gas	*Effect of uncapped cells on landfill gas production.*	The uncapped cells allow more water into the landfill and therefore more gas production.
	Monitoring/control of concentration and migration of methane, carbon dioxide, non-methane organic compounds (NMOCs).	There is no landfill gas monitoring station. Without a cap the gases cannot be controlled.
	Monitoring/control of lateral migration of landfill gas.	Lateral gas migration is not a serious issue given the HDPE lined cells and that the cells are largely above grade.
	Monitoring/control of airborne particulate and odour.	Capping, gas collection and flaring or gas utilization is recommended to control odours and reduce greenhouse gas emissions.
Review of Issues Related to Domestic Wells	*Location of wells tested.*	Appears adequate, based on a 1997 plan. Should update and reevaluate.
	Number of wells tested.	Marginal. Well owners should be encouraged to continue to participate in monitoring program to provide as large a sample population as practical.
	Frequency of testing.	Increase to document seasonal conditions.
	Parameters tested.	Considered generally adequate, but should be reviewed in context of developing detailed EMP trigger parameters.

Specifications		Comments
	Adequacy of emergency response plans relative to domestic well contamination.	General framework is adequate. More work required in terms of practical implementation (e.g. trigger parameters and levels referenced in EMP require definition).
	Devise a system whereby results of domestic well tests can be managed.	Further work required.

Discussion of Landfill Issues

The design and operation of the landfill requires a coordinated approach consistent with the original design concept, such that the liner design is compatible with the operation of the leachate controls and the landfill closure philosophy.

The leachate system operation needs to consider the landfill liner design concept relative to the depth of leachate over the liner and the collection sump. The original objective was to keep the leachate levels as low as possible and therefore this approach should be maintained, which means the landfill cells should not be used for leachate storage.

The landfill should be capped according to the design assumptions of each cell. For example Cell #1 and #2 designs assumed that these cells would be capped shortly after reaching capacity. This has only been done on the sideslopes. Capping these two cells would reduce leachate production.

If the landfill cells are not going to be progressively closed as each cell is completed, then the design of the liner system for those cells should reflect that design approach. If the cells are going to left open for an extended period of time, resulting in higher leachate production levels and higher leachate levels over the liner, then consideration should be given to a double liner system.

The Cell #1 clay liner under the sump is 900 mm compared to 1300 mm under the Cell #3 sump. The rest of Cell #1 and Cell #2, which flows through Cell #1, have a 600 mm clay layer under the whole liner. The design of the cell's composite clay/geomembrane liner takes advantage of the high quality marine clay locally available. This is a key factor in the selection of the liner design.

The design of Cell #3 includes a thicker 1300 mm clay layer under the leachate collector sump, and a thickening of the liner's clay layer from 600 mm to 1000 mm at the lower east end of the landfill. This design improvement provides a higher quality barrier system. This would seem to reflect the operational concept of some leachate storage in the sump and lower portion of the landfill.

Given the difference in clay thicknesses, the leachate level within Cell #1 should be maintained as low as possible at all times. Given that the system is manually operated to pump into tanker trucks as they are available, there are potentially times when the leachate level periodically gets elevated and ponds in the lower portion of Cells #1 and #3. As a initial improvement, consideration could be given to automating the system so that the excess leachate is pumped directly to the Surge Pond for storage. In this case leachate levels will be at a higher level and therefore a double liner system for the pond should be considered. Also, an aeration system could be utilized to pre-treat the leachate if the BOD levels increase.

The long term solution, which the FRSWC is evaluating, is to construct a pump station and forcemain that would discharge at the Lancaster treatment plant. This would allow direct pumping of leachate without having to wait for tanker trucks, and therefore minimize leachate ponding over the liners.

The FRSWC plans to increase the finished landfill height from 90 m to 105 m. This concept should be coordinated and integrated with the design concepts and assumptions of each cell. It is noted that the final closure concept needs to be updated to reflect the Surge Pond being maintained as a permanent component of the landfill. The Surge Pond creates a significant cutout in the landfill footprint, which tends to isolate Cells #1 and #2 as well as Cell #3. Therefore those areas cannot be effectively raised to the 105 m level. Hence, these areas should be brought to final grade of 90 m for closure.

Overall, a clearly defined Design and Operations Plan should be developed that would provide clear direction for the design on each new cell, when to close completed cells, and how the leachate system would be operated for each cell.

12.3 Recommendations

Based on the findings of this review, recommendations have been developed. These relate to RFP Item 4.2, proposals for remedial measures, and Item 4.3, proposals for regular, ongoing monitoring/ review of the landfill. The recommendations are as follows:

Approval to Operate

1. That the FRSWC comply with all aspects of the Approval to Operate.

2. Apply for an amendment to the Approval to reflect the current leachate treatment and disposal strategy.

3. Establish an air quality sampling station during construction activities.

Groundwater Monitoring Wells

4. Install deeper bedrock monitoring wells and update hydrogeological characterization.

5. Define "trigger" parameters for groundwater monitoring samples.

6. Complete a detailed interpretation of the groundwater monitoring data.

7. Establish a monitoring database that includes analysis for data trends.

Leachate Management

8. Implement a strategy of progressive landfill closure.

9. Reduce the leachate level in the cells or consider double liner in future cells.

10. Consider automatically pumping leachate to the Surge Pond, upgrade the liner to a double liner and possibly pre-treat the leachate before discharge.

11. Complete a detailed analysis of the underdrain monitoring data.

Stormwater

12. Develop specific stormwater management plans for each phase of construction.

13. Complete a detailed analysis of the stormwater monitoring data.

Hazardous Waste

14. Establish a Household Hazardous Waste drop-off facility at the landfill.

Waste Diversion

15. Establish an on-site recycling facility at the landfill.

Landfill Gas

16. Install a landfill gas collection and flaring or utilization system to reduce odours and greenhouse gases.

Domestic Wells

17. Update the well location plan based on current participants, and reevaluate the number and location of wells.

18. Encourage homeowners to participate in the domestic well monitoring program.

19. Increase frequency of domestic well monitoring to document seasonal conditions.

20. Define "trigger" parameters for domestic well monitoring samples.

21. Complete a detailed interpretation of the domestic well data.

22. Establish a domestic well monitoring database that includes analysis for data trends.

Operations

23. Install an on-site rainfall monitoring gauge.

24. Prepare a Design and Operations Plan that defines the landfill development, closure and leachate management strategies.

Crane Mountain Enhancement, Inc.

25. The Crane Mountain Enhancement, Inc. continue to provide ongoing review of the landfill's monitoring programs to help ensure that adequate analysis is conducted of the monitoring data.
26. That Crane Mountain Enhancement, Inc. continue to work with the Fundy Region Solid Waste Commission to help improve the operation of the Crane Mountain Landfill.

These recommendations provide measures to improve the operation of the Crane Mountain Landfill, improve analysis of the monitoring data, and to suggest improvements to the planning and implementation of landfill development. The implementation of these recommendations should help to improve the protection of groundwater and surface water quality.

13.0 REFERENCES

Some of the main reference documents are indicated below. In addition to these, design drawings for most stages of the landfill development were reviewed.

Dec. 1994, Environmental Impact Statement, Regional landfill at Crane Mountain or Paddy's Hill Sites, Neill and Gunter Ltd.

March 1997, Crane Mountain Landfill Preliminary Design Report, Porter Dillon Limited

May 1997, Geotechnical Investigation, Crane Mountain, Saint John, N.B., Fundy Engineering & Consulting Ltd.

Sept. 1997, Review of Environment Impact Statement, Regional Landfill at Crane Mountain, Facflow Consultants Inc.

Nov. 1997, Environmental Management Plan for the Fundy Region Waste Management Facility, Neill and Gunter Ltd. and Gemtec Ltd.

Nov. 1997, Fundy Region Waste Management Facility, Operations Manual (Rev. 0), Porter Dillon Ltd.

April 1998, Crane Mountain Landfill, Leachate Treatment Design-Build, Porter Dillon Ltd.

Aug. 2001, Emergency Response Procedures, Crane Mountain Landfill, Fundy Region Solid Waste Commission.

Nov. 2001, Development of Construction and Demolition Site, Gemtec Ltd.

Nov. 2001, Letter Re: Fundy Regional Landfill - C&D Site, John Stubbert, DOELG.

Nov. 2004, Registration of an Undertaking - EIA Regulation 87 - 83, Increase Crane Mountain Landfill Cell Final Elevation from 90 to 105 Metres, FRSWC.

Dec. 10, 04, Letter Re: EIA Registration # 1025 - Crane Mountain Landfill Cell Elevation Increase, Germaine Pataki-Thériault, DOELG.

Dec. 14, 04, Letter Re: EIA Registration # 1025 - Crane Mountain Landfill Height Increase, Germaine Pataki-Thériault, DOELG.

June 21, 05, Letter Re: Crane Mountain Landfill, Review of Leachate Breakthrough Through Clay Liner, Gemtec Ltd.

APPENDIX A

CURRENT APPROVAL TO OPERATE, SL6 - R

Environment and Local Government
Environnement et Gouvernements locaux

New Nouveau Brunswick

December 5, 2003
File: 2-6915-F2

Mr. Bernie Desmond
Fundy Region Solid Waste Commission
P.O. Box 3144, Station B
Saint John, New Brunswick
E2M 4X7

Dear Mr. Desmond:

Re: Renewal of Approval to Operate, SL6-R1 issued

The Approval to Operate for the Crane Mountain Landfill has been renewed. Please find attached a copy of the new Approval, SL6-R1.

Please ensure that the appropriate personnel at the landfill have taken some time to review this document. I would like to point out that it has been altered since the issuance of the previous Approval.

Please contact me if you have any questions about the terms and conditions of this Approval or any other matter. My direct line is 444-6728.

Thank you,

Kevin Gould, P.Eng.
Solid Waste Engineer
Stewardship Branch

Attachment:

cc: Susan Atkinson, Director - Region 4 (Saint John) Office
Jack Keir, General Manager - Fundy Region Solid Waste Commission
Kevin Gould

P.O. Box 6000
Fredericton
New Brunswick

Case postale 6000
Fredericton
Nouveau-Brunswick

New Nouveau Brunswick

APPROVAL TO OPERATE

SL6-R1

Pursuant to paragraph 5 (3) (a) of the Air Quality Regulation – *Clean Air Act* and paragraph 8(1) of the Water Quality Regulation – *Clean Environment Act*, this Approval to **Operate** is hereby issued to:

Fundy Region Solid Waste Commission

for the operation of the

Crane Mountain Sanitary Landfill

Description of source:	**A Regional Sanitary Landfill (and Construction and Demolition Debris Disposal Site) handling municipal solid waste (MSW) in Saint John and the western portion of Kings and Queens Counties of New Brunswick.**
Parcel Identifier (PID) Numbers:	**55087001, 55087027, 55086987, 55087019, 55043301 & 55043293**
Mailing Address:	**Fundy Region Solid Waste Commission** **P.O. Box 3144, Station B** **Saint John, New Brunswick** **E2M 4X7**
Conditions of Approval:	**Per attached Schedules "A", "B", & "C"**
Supersedes Approval:	**SL6-R2002**
Valid from: **January 1, 2004**	Expiry date: **December 31, 2006**

Recommended by: G. Haines
Environmental Management Division

Authorized by: Brenda Fowlie
Minister of Environment and Local Government

Dec 17, 2003
Date

Schedule "A"

A. DESCRIPTION AND LOCATION OF THE SOURCE:

The Fundy Region Solid Waste Commission operates a modern solid waste landfill that is commonly referred to as the Crane Mountain Landfill. The Landfill is located near the northern limits of the City of Saint John at the intersection of Highway #7 and Route #177, near the Town of Grand Bay – Westfield and approximately 4 km southwest of Martinon. The facility is primarily designed to serve the residents of Saint John County and the western portions of Kings and Queens Counties in the Province of New Brunswick. The Commission also operates a construction and demolition (C&D) debris disposal site at the landfill. The Fundy Region Solid Waste Commission has purchased buffer properties identified by P.I.D. numbers 55086995 and 55087035.

As a result of the operation of the landfill, there exist *potential* environmental impacts from: 1) the generation of leachate resulting from the disposal of waste in the landfill disposal cells and debris in the C&D Site; 2) site run-off impacting off-site receptors; 3) fugitive dust emissions from truck traffic and other on-site activities; and 4) elevated odour and noise emissions.

The operation of the Crane Mountain Landfill and C&D Site by the Fundy Region Solid Waste Commission, located in the City of Saint John, County of Saint John, and the Province of New Brunswick and identified by Parcel Identifier (PID) numbers 55087001, 55087027, 55086987, 55087019, 55043301 and 55043293 is hereby approved **subject to the following:**

B. DEFINITIONS

1. **"Approval Holder"** means Fundy Region Solid Waste Commission.

2. **"Department"** means the New Brunswick Department of Environment and Local Government.

3. **"Minister"** means the Minister of the Department and includes any person designated to act on the Minister's behalf.

4. **"Director"** means the Director of the Stewardship Branch of the Department and includes any person designated to act on the Director's behalf.

5. **"inspector"** means an inspector designated under the *Clean Environment Act*, *Clean Air Act* or the *Clean Water Act*.

6. **"C&D Site"** means the portion of the Facility dedicated to the disposal of C&D debris.

7. **"Facility"** means the property, buildings, and equipment as identified above in the Description and Location of the Source, including the C&D Site, and all contiguous property in the title of the Approval Holder at that location used for the purpose of disposing of construction and demolition debris and solid waste.

8. **"C&D debris"** means debris resulting from the construction, renovation and/or demolition of a structure.

9. **"watercourse"** means the full width and length, including the beds, banks, sides and shoreline, or any part of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, the primary function of which is the conveyance or containment of water whether the flow be continuous or not.

10. **"petroleum product"** means a mixture of hydrocarbons, or their by-products, of any kind and in any form including airplane fuel, asphalt, bunker "C" oil, crude oil, diesel fuel, engine oil, fuel oil, gasoline, kerosene, lubricants, mineral spirits, naphtha, petroleum based solvents regardless of specific gravity, transformer oil and waste petroleum products and excluding propane and paint.

11. **"sludge"** means a solid, semi-solid or liquid residue having less then 15% solids generated during the treatment of municipal and/or industrial wastewater, or generated as a result of other processes with the exception of sludge from the on site leachate treatment system only.

12. **"liquid waste"** means bulk liquids in a volume greater then 20 litres, with the exception of septage from on-site sewage systems only.

13. **"liquid oily waste"** means any waste containing free flowing petroleum products.

14. **"hazardous waste"** means any waste identified under the federal *Transportation of Dangerous Goods Act, 1992*) and does not include waste generated in the residential waste stream in quantities less than five litres or five kilograms.

15. **"friable asbestos"** means waste material containing asbestos fibre or asbestos dust that is **not** tightly bound within a solid matrix such that it is easily crumbled by the hands in a concentration greater than 1% by weight.

16. **"biomedical waste"** means waste that is generated by human or animal health care facilities, medical or veterinary research and teaching establishments, health care teaching establishments, clinical testing or research laboratories and facilities involved in the production or testing of vaccines. The types of biomedical waste are: a) Human Anatomical Waste; b) Animal Waste; c) Microbiology Laboratory Waste; d) Human Blood and Body Fluid Waste and e) Waste Sharps as defined in the "CCME Guidelines for the Management of Biomedical Waste in Canada." Biomedical waste does not include waste that is from animal husbandry in reasonable amounts, household in origin, controlled in accordance with the *Health of Animals Act (Canada)*, formerly the *Animal Disease Protection Act (Canada)*, or generated in the food production, general building maintenance, and office administration activities of those facilities to which this definition applies.

C. GENERAL INFORMATION

17. An inspector, at any reasonable time, has the authority to inspect the Facility and carry out such duties as defined in the *Clean Environment Act, Clean Water Act* or *Clean Air Act.*

18. The issuance of this Approval does not relieve the Approval Holder from compliance with other applicable federal or provincial acts, regulations or guidelines or local bylaws.

19. If, in the opinion of the Minister, the environmental impact resulting from the operation of the Facility is unacceptable, the Minister may revoke this Approval and issue a new Approval.

20. The Approval Holder shall maintain a copy of this Approval in the on-site office or other location where it can be easily accessed.

21. The Approval Holder shall immediately notify the Department in writing of any change in the legal name or address of the Facility.

22. The Approval Holder shall operate the Facility in accordance with the terms, conditions and intent of the Environmental Management Plan.

D. TERMS AND CONDITIONS

General Conditions

23. The Approval Holder shall ensure that the Facility is operated in compliance with *Water Quality Regulation 82-126* filed under the *Clean Environment Act* of the Province of New Brunswick and the *Air Quality Regulation 97-133* filed under the *Clean Air Act* of the Province of New Brunswick. Violation of any term and condition herein stated constitutes a violation of the *Clean Environment Act* and/or the *Clean Air Act.*

24. The Approval Holder shall ensure that any item received at the Facility containing ozone-depleting substances, included but not limited to those utilized for refrigeration and/or air conditioning, are decommissioned according to the *Ozone Depleting Substances Regulation 97-132* filed under the *Clean Air Act.*

25. **Prior to September 30, 2006,** the Approval Holder shall make application in writing to the Director for a renewal of this Approval. The application shall include documentation supporting any proposed changes to the conditions of Approval or operation of the Facility.

26. The Approval Holder shall operate the Facility so as to minimize the quantity of any contaminant discharged to the environment, or released to the atmosphere.

27. In the event of closure of the Facility or the C&D Site, the Approval Holder shall, in addition to any requirements under the *Environmental Impact Assessment Regulation 87-83* filed under the *Clean Environment Act*, prepare plans for complete site rehabilitation and ongoing monitoring and leachate treatment. The plans shall be submitted to the Department for review at **least six (6) months** before the planned closure date. The documentation shall include, but not be limited to, updated site plans as well as an engineering proposal for the site rehabilitation and closure.

Operating Conditions

28. The Approval Holder shall ensure that the Facility is not used for the disposal of:

- Liquid wastes;
- Sludge;
- Liquid oily wastes;

- Hazardous wastes;
- Petroleum contaminated soil; and
- Untreated biomedical waste, except for sharps from veterinarians that have been placed in a proper "sharp disposal container".

29. The Approval Holder shall ensure that supervision is provided at the Facility during normal operating hours and that incoming waste at the Facility is routinely scrutinized.

30. The Approval Holder shall ensure that the visibility buffer that has been established on the south and west borders of the site is maintained at a height of at least 6 meters.

31. The Approval Holder shall establish, manage and annually contribute to a post-closure liability fund in accordance with the requirements of the *Regional Solid Waste Commissions Regulation 96-11* filed under the *Clean Environment Act.*

32. The Approval Holder shall ensure that the assumptions made with respect to projected post-closure costs are reviewed at least every five years. Following review and approval of the report by the Department, adjust the annual contributions to the post-closure fund to reflect the updated assumptions.

33. The Approval Holder shall ensure that a monthly Waste Inventory is maintained for the Facility that includes as a minimum, a record of incoming waste quantities, the quantity of disposed waste, and the quantity of recycled wastes received at the Facility, including the C&D Site.

34. The Approval Holder shall ensure that the guidelines for Pits and Quarries, attached as Schedule "B" is complied with.

35. The Approval Holder shall ensure that the Facility is kept free of rodents as outlined in the Environmental Impact Assessment in a manner that is in compliance with the pest control requirements outlined in Schedule "D".

36. The Approval Holder shall ensure that no unauthorized scavenging is permitted at the Facility.

37. The Approval Holder shall ensure that the waste in the disposal cells at the Facility is covered at the end of each operating day with a minimum of 150 mm of soil, or approved alternative.

38. The Approval Holder shall ensure that degradable plastic is not used as an alternate daily cover.

39. The Approval Holder shall ensure that wind blown debris and litter at the Facility is controlled. Adequate barriers and/or fencing shall be utilized to confine debris and litter to the immediate disposal area. Any debris or litter not contained in the disposal cells shall be routinely collected and disposed in an appropriate location.

Construction and Demolition Debris Disposal Site

40. The Approval Holder shall ensure that the C&D Site adheres to the following set-back distances:

Water Supply Wells and Residence	300 m
Institutional Land Use	300 m
Residence	300 m
Industrial/Commercial Land Use	150 m
Watercourse	150 m
Right-of-Way of Public Roads	150 m
Distance to Property Line	50 m

The above are recommended separation distances, however these may be modified if deemed necessary by an inspector in order to make the C&D Site more environmentally acceptable.

41. The Approval Holder shall ensure that only acceptable C&D debris is accepted at the C&D Site for disposal. Acceptable materials are those associated with the construction, renovation and/or demolition of a structure and include:

- Concrete and brick;
- Untreated wood;
- Siding, ceiling tile, gyproc, insulation;
- Solid roofing materials - **no** cans, drums or other packages (empty or otherwise) of roofing adhesives, tar or waterproofing compounds;
- Glass, metals and durable plastics from the demolition of a building;
- Floor coverings associated with the demolition or construction of a building (no containers of mastic, paint or finishing products); and
- Broken and aged asphalt only, **no** cans, drums or other packages (empty or otherwise) of sealers, adhesives, tar or waterproofing compounds or new asphalt product.

The following are <u>unacceptable</u> for disposal at the C&D Site:

- Municipal solid wastes;
- Household wastes;
- Industrial wastes;
- Liquid, putrescible or bulky wastes;
- Petroleum contaminated soil or products;
- Paint cans;
- Lead paint that is flaking or chipping and/or if the concentration is known to be greater then 1% (1000ppm) by volume;
- Light ballasts containing PCBs;
- Friable asbestos;
- Office, business or lunchroom wastes;
- Mattresses, sofas and other furniture;
- Carpets and other sheet flooring, either new or used, other then flooring that is attached to a building during demolition;
- Electronics, computers and their accessories;
- White goods (such as refrigerators, stoves, etc.) and other appliances;

- Items subject to the *Transport of Dangerous Goods Regulations* or the *Ozone Depleting Substances Regulation 97-132*;
- Snow containing road salt and/or debris;
- Vehicles, tires or batteries;
- Dredge spoils; and
- Material from the demolition of any building, which has the potential to contain contaminated materials, associated with its former use (such as, but not limited to, a pesticide storage warehouse).

42. The Approval Holder shall ensure that wastes or debris that originates outside of the Province of New Brunswick is not accepted at the Facility unless specifically approved by the Minister following an evaluation under the *Environmental Impact Assessment Regulation*. Contact the Project Assessment Branch at (506) 444-5382 for further information.

43. The Approval Holder shall ensure that all incoming C&D debris at the Facility is scrutinized and **any** unacceptable materials disposed at the C&D Site are immediately removed and taken to a location approved by the Department for disposal.

44. The Approval Holder shall ensure that debris in the C&D Site is covered at the end of each week with a granular cover material at least 150 mm deep.

45. The Approval Holder shall ensure that a 50 metre treed or bermed buffer zone is maintained on the southern, northern and western boundaries of the C&D Site. It is understood at this time that the entire approved area for the C&D Site may be clearcut as part of a scientific evaluation of woodlot procedures. Ensure that the clearcut area is not grubbed if the scientific evaluation proceeds.

46. The Approval Holder shall ensure that the C&D Site is designed, constructed and operated such that debris is contained in the disposal area and surface water is prevented from flowing into the debris disposal area. No C&D debris is to be disposed in freestanding water.

47. The Approval Holder shall ensure that every effort is made to salvage debris for recycling or reuse as much as possible prior to disposal in the C&D Site.

48. The Approval Holder shall ensure that a minimum of 1.5 metres of overburden is maintained between the C&D debris and the bedrock and seasonal high groundwater.

Site Management and Maintenance

49. The Approval Holder shall ensure that the leachate collection piping at the Facility is properly maintained to ensure they remain free flowing.

50. **Prior to August 27, 2004**, and at least once every two years thereafter, the Approval Holder shall ensure that the leachate collection piping is inspected by video or other method pre-approved by the Department, to ensure the system is in proper working condition.

51. The Approval Holder shall ensure that a secure gate or barrier is provided at the entrance of the Facility to prevent unauthorized access to the Facility outside of normal operating hours. Appropriate signs shall be erected to inform the public of the hours of operation.

52. The Approval Holder shall ensure that the drainage ditches at the Facility are maintained to ensure they remain free flowing at all times.

53. The Approval Holder shall ensure that all ditches and cleared areas at the Facility are stabilized and maintained with the use of vegetation, rock, fabric, and/or other approved devices.

54. The Approval Holder shall ensure that all publicly accessible areas at the Facility are properly maintained to provide safe, year-round access.

55. The Approval Holder shall ensure that enough cover material is available at the Facility to provide the C&D Site with the required weekly cover and the disposal cells with the required daily cover.

56. The Approval Holder shall ensure that disposal areas at the Facility that will be inactive for at least three months are covered with a 300 mm intermediate cover layer, graded to promote drainage and minimize erosion and infiltration. Drainage from the intermediate cover may be directed down the side slopes if the final cover is installed on the adjacent side slopes, otherwise the drainage shall be directed to within the disposal cell. Remove the intermediate cover prior to continuing waste placement in that area.

57. The Approval Holder shall ensure that salvaging of white goods, scrap metals, computers, propane tanks/canisters, etc. at the Facility are carried out in an area separate from the main waste disposal area.

58. The Approval Holder shall ensure that a secure area is provided at the Facility for the storage of tires and that they are taken to location approved by the Department for disposal on a regular basis.

59. The Approval Holder shall ensure that a buffer strip of native softwood trees is maintained around the Facility in accordance with the Environmental Impact Assessment Study.

Waste Disposal

60. The Approval Holder shall ensure that hot loads arriving at the Facility containing ashes or other materials that could potentially cause a fire in the waste disposal area are temporarily stored in a separate secure location. Once the risk of fire has been eliminated the material shall be disposed in the designated waste disposal area.

61. The Approval Holder shall ensure that no waste at the Facility is deposited within 150 metres of any watercourse.

62. The Approval Holder shall ensure that there is a continuous, permeable layer of gravel surrounding the waste at the Facility from the top of the upper side slopes through the top of the berm area to the leachate collection system. Particular care must be exercised at the top of berm area so that the final cover will properly intersect the top of berm.

Asbestos Disposal

63. The Approval Holder shall ensure that an "Asbestos Disposal Record" is maintained. The Record shall include, but not necessarily be limited to, the disposal date, volume of asbestos waste, origin of the shipment, contractor delivering the asbestos waste and a detailed plan of the disposal location.

64. The Approval Holder shall ensure that friable asbestos generated within New Brunswick is accepted at the Facility by appointment only.

65. The Approval Holder shall ensure that any friable asbestos accepted at the Facility has been wetted, placed in securely tied, double bagged 6 mil polyethylene bags or securely tied single 6 mil polyethylene bag that has been placed in a drum or cardboard box with all seams securely taped and each bag, cardboard box and/or drum is clearly labeled "WASTE ASBESTOS UN2590" or "DECHETS D'AMIANTE UN2590" and there are no punctures in the containers (if they are punctured, the contents must be wetted and repackaged prior to land filling) and they are placed at a dedicated location within the engineered portion of the sanitary landfill and are immediately covered with a minimum of 300 mm of clean cover material.

66. The Approval Holder shall ensure that there is a sufficient quantity of wetting agent on-site when asbestos is being handled and disposed at the Facility.

67. The Approval Holder shall ensure that any unloading of friable asbestos at the Facility is done by the driver or his assistant and that they or any personnel at the Facility who handle the asbestos are wearing the proper respirators and clothing during the unloading and disposal of the asbestos waste. The manager of the Facility must supervise the unloading and covering of the asbestos waste.

Construction and Expansion Activities

68. The Approval Holder shall ensure that the necessary engineering documentation is submitted to, and approved by, the Director for approval prior to the construction of additional waste disposal cells, sludge handling facilities, leachate treatment systems, facilities for processing recyclables or any other pertinent construction activity at the Facility.

69. The Approval Holder shall ensure that the high volume air quality sampling station at the Facility is maintained in proper working condition for measuring total suspended particulate (TSP) matter for use as specified in subsequent Approvals to Construct.

70. The Approval Holder shall ensure that final cover applied to the containment cells at the Facility shall be a minimum of 300 mm granular layer, 600 mm low permeability clayey till @ 1×10^{-7} cm/sec hydraulic conductivity, 150 mm granular protection layer, 150 mm growing medium and vegetative cover or Approved alternative, and shall be sloped a minimum of 2% to promote precipitation runoff from the disposal cell. All holes, cave-ins and faults shall be filled in or repaired, as required, until the final cover has been properly stabilized. Upper side slopes shall be less than 4 horizontal to 1 vertical.

Discharges and Emissions

71. The Approval Holder shall ensure that any discharge from the sedimentation pond at the Facility to a watercourse has a Total Suspended Solids (TSS) value of less than 25 mg/l.

72. The Approval Holder shall ensure that the pH of the permeate (treated leachate) at the Facility has been adjusted and is between 6.5 and 9.0 prior to discharge to the environment.

73. The Approval Holder shall ensure that the dissolved oxygen of the permeate at the Facility is between 5.5 mg/l and 9.5mg/l prior to discharge to the environment.

74. The Approval Holder shall ensure that no burning is conducted at the Facility, including the C&D Site.

75. The Approval Holder shall ensure that all surface water generated at the Facility that does not come into contact with waste is directed to the surface water drainage system and bypasses the leachate storage and treatment system.

76. The Approval Holder shall ensure that odour or noise emissions released as a result of the operation of the Facility, including the C&D Site, are controlled to prevent impacts to off-site receptors. In the event that odour or noise emission impacts do occur, the Department may require the Approval Holder to develop, submit and implement an odour or noise Control Plan that mitigates the impacts such that they no longer cause a nuisance to off-site receptors. The Control Plan shall be submitted to the Department for review and approval prior to implementation.

Sampling and Monitoring

77. The Approval Holder shall ensure that an experienced and qualified technician conducts all sampling at the Facility and a laboratory approved by the Department conducts the required analysis.

78. The Approval Holder shall ensure that groundwater elevations are recorded for each sampling event and that groundwater samples to be submitted for trace metal analysis are field filtered using 0.45 µm in-line waterra filter or equivalent. All other samples should be unfiltered.

79. The Approval Holder shall ensure that the results of all sampling and analysis at the Facility are kept on file in both a hardcopy and electronic version.

80. The Approval Holder shall ensure that for each discharge of water from the sedimentation pond a sample is obtained at the mid-point of the discharge event and analyzed for TSS.

81. Monitoring wells to be sampled at the Facility consist of nests of multi well installations of various depths. The well nests are understood to be comprised of the following:

Well Nest	Shallow Till	Deep Till	Shallow Bedrock	Mid Bedrock	Deep Bedrock
MW17	-	-	MW17-S		MW17-D
MW18	-	MW18	-		-
MW22	-	-	MW22-S		MW22-D
MW31	-	-	MW31-S	MW31-U	MW31-L
MW32	-	-	MW32-U	MW32-L	-
MW33	MW33-S	-	MW33-U	-	-
MW34	MW34-S	-	MW34-U		-
MW35	MW35-S1	MW35-S2	MW35-L	-	-
MW36	MW36-S	-	MW36-U	-	MW36-L
MW37	MW37-S				
MW38	MW38-S	-	MW38-U	MW38-L	
MW39	MW39-S	-			
MW40	MW40-S	-	MW40-U	-	-
MW41	MW41-S	-	MW41-U	MW41-L	-
MW42	MW42-S	-	MW42-U	-	MW42-L
MW43	MW43-S	-	MW43-U	-	-
MW44	MW44-S	-	MW44-U	-	-
MW45	-	-	MW45-U	-	MW45-L
MW46	-	-	MW46-U	-	MW46-L
MW47	MW47-S	-	MW47-U	-	MW47-L
MW48	MW48-S	-	MW48-U	-	MW48-L
MW49	MW49-S	-	MW49-U	MW49-L	-
MW50	MW50-S	-	MW50-U	-	MW50L
MW51	MW51-S1	MW51-S2			MW51-D
MW52	MW52-S			MW52-D	
MW53		-		MW53-D	

82. For the purposes of this Approval, "GENERAL CHEMISTRY" shall include the following analyses:

Ammonia (as NH_3-N)
Alkalinity (as $CaCO_3$)
Calcium
Chloride
Conductivity (field parameter)
Copper
Dissolved Oxygen (field parameter)
Iron
Nitrate-Nitrite (as N)
Magnesium
Manganese
o-Phosphate (as P)
pH
Potassium
r-Silica (as SiO2)
Sodium
Sulfate
Temperature (field parameter)
Total Dissolved Solids
Total Organic Carbon
Turbidity
Zinc

with the associated calculated parameters:

Bicarbonate (as $CaCO_3$)	Cation sum	Hardness (as $CaCO_3$)
Carbonate (as $CaCO_3$)	Anion sum	Ion sum
Hydroxide (as $CaCO_3$)	% difference	Saturation pH (5°C)
	Theoretical conductance	Langelier Index (5°C)

83. For the purpose of this approval, "TRACE METALS" shall include the following analyses:

Aluminum	Copper	Selenium
Antimony	Iron	Silver
Arsenic	Lead	Sodium
Barium	Magnesium	Strontium
Beryllium	Manganese	Thallium
Bismuth	Mercury	Tin
Boron	(CVAAS)	Uranium
Cadmium	Molybdenum	Vanadium
Calcium	Nickel	Zinc
Chromium	Potassium	
Cobalt		

84. The Approval Holder shall ensure that monitoring wells MW31S, MW31U, MW31L, MW33U, MW34S, MW34U, MW35S1, MW35S2, MW35L, MW36S, MW36U, MW36L, MW37S, MW38S, MW38U, MW38L, MW39S, MW40S, MW41S, MW41U, MW41L, MW42S, MW43S, MW43U, MW44-S, MW44-U, MW45U, MW45L, MW50S, MW50U, and MW50L are sampled and analyzed two times annually for each individual well for the following parameters. Samples should be taken in April and September of each year.

GENERAL CHEMISTRY TRACE METALS

85. The Approval Holder shall ensure that the groundwater monitoring wells MW51D, MW51S1, MW51S2, MW52D, MW52S, MW53D are sampled in the months of April, August and October of each year and analyzed for the following parameters:

BTEX/TPH	TRACE METALS
GENERAL CHEMISTRY	Groundwater elevations

86. The Approval Holder shall ensure that the groundwater monitoring wells MW33U, MW34S, MW34U, MW35S1, MW35S2, MW35L, MW38U, MW41S and MW41U are sampled in the months of February, April, July, September and November of each year and analyzed for the following parameters:

GENERAL CHEMISTRY

87. The Approval Holder shall ensure that the disposal cell underdrains (UD2 and UD3) shall be sampled in the months of February, April, July, September and November of each year and analyzed for the following parameters:

GENERAL CHEMISTRY TRACE METALS

88. The Approval Holder shall ensure that the groundwater monitoring well nests MW32, MW40, MW42, MW46, MW47, MW48, MW49 are sampled in conjunction with the September monitoring event yearly and analyzed for the following parameters:

GENERAL CHEMISTRY TRACE METALS

89. The Approval Holder shall ensure that the surface water sampling stations SW1, SW2, SW3, SW4, SW5, SW6 and the sedimentation pond discharge shall be sampled in April and September of each year and analyzed for the following parameters:

GENERAL CHEMISTRY

The sedimentation pond discharge shall be sampled at the mid-point of a discharge event.

90. The Approval Holder shall ensure that in September or October of each year the domestic wells chosen for the Domestic Well Monitoring Program are sampled and analysed for:

GENERAL CHEMISTRY (except dissolved oxygen)

91. **Prior to August 4, 2006**, the Approval Holder shall ensure that a 'Monitoring Program Review' is conducted by a qualified independent third party that includes, but is not necessarily limited to:

- Well location, performance and the groundwater flow system;
- Analytical database;
- Adequacy of the background data with respect to scope and variability;
- Identification of possible analytical anomalies with particular attention to leachate indicator parameters; and
- Recommendations for monitoring and remediation of any potential environmental impacts.

Leachate Treatment System

92. The Approval Holder shall ensure that the leachate levels in the disposal cells at the Facility are monitored and recorded Monday thru Friday. If precipitation is scheduled on Saturday and/or Sunday, or if the leachate levels in the disposal cells are high, then monitoring on Saturday and Sunday is also required.

93. The Approval Holder shall ensure that any leachate taken from the Facility to the Lancaster Wastewater Treatment Facility for disposal is pre-treated to a level below the maximum allowable influent contaminant levels for discharge at the Lancaster Facility as directed by the City of Saint John.

94. The Approval Holder shall ensure that the leachate collection and treatment system is operated such that the leachate levels in the disposal cell do not compromise the 25-year advective breakthrough requirement for the cell liner system.

95. The Approval Holder shall ensure that a contingency plan is in place at the Facility in the event that the cascade does not work effectively and/or the permeate does not meet the discharge requirements.

96. The Approval Holder shall ensure that a sample of the permeate within the discharge ditch at the Facility is collected daily to verify that pH is within the discharge range of 6.5-9.0. If the discharge falls outside these limits, the Approval Holder shall stop the discharge of the permeate. Daily sampling may not be omitted for more than two consecutive days during discharge periods excluding holidays.

97. The Approval Holder shall ensure that the permeate within the permeate discharge tank at the Facility is sampled at least once per week to verify that dissolved oxygen is in the range of 5.5 mg/l and 9.5 mg/l. Discharge of the permeate shall stop if the dissolved oxygen within the tank is outside of these limits.

98. The Approval Holder shall ensure that permeate conductivity at the Facility is continuously monitored and discharge of the permeate ceases if conductivity readings rise beyond acceptable levels.

99. The Approval Holder shall ensure that the flow measuring devices installed at the Facility required to verify the amount of permeate discharged from the leachate treatment system are maintained in proper working condition at all times.

100. The Approval Holder shall ensure that the permeate discharged from the leachate treatment system to the manmade wetland surface water drainage system at the Facility meets the following discharge requirements:

- The Canadian Environmental Quality Guidelines for the Protection of Drinking Water **on a monthly (as a minimum) grab sample basis** for Mercury, GENERAL CHEMISTRY & TRACE METALS (except for dissolved oxygen), for which the Canadian Environmental Quality guidelines have identified a Drinking Water Quality maximum acceptable concentration or interim maximum acceptable concentration;
- The Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life **on a yearly weighted average of the contaminate loading** for Mercury, GENERAL CHEMISTRY & TRACE METALS (except for dissolved oxygen), for which the Canadian Environmental Quality guidelines have identified a Freshwater Aquatic Life maximum acceptable concentration or interim maximum acceptable concentration.

For example,

$$C_{AVG} = \frac{\Sigma (Q^*C)}{Q_T}$$ where:

C_{AVG}	is the weighted average of the contaminant loading, in mg/l
Q	is the permeate flow in the monthly sample period, in litres
C	is the concentration in the sample, in mg/l
Q_T	is the total yearly flow, in litres

Reporting

101. The Approval Holder shall ensure that a plan is submitted, and approved by, the Director for the installation of additional tier 1 and tier 2 monitoring wells prior to preparing cell 4 or 5 for construction. The additional monitoring wells, if required, shall be installed and operational prior to accepting waste in the new cells.

102. **Prior to January 31, 2004**, the Approval Holder shall submit to the Department a Site Map and Report. The Site Map and Report shall include as a minimum, a "flow-chart" of the Facility that includes the leachate collection system and site run-off collection/treatment process, a map clearly illustrating all required sampling points and a chart that details the Well Nest locations.

103. **Prior to April 30, 2004,** the Approval Holder shall submit a copy of the contingency plan that is in place at the Facility to manage the permeate in the event that the cascade does not work effectively and/or does not meet the discharge requirements.

104. **Prior to April 30, 2004,** the Approval Holder shall submit a copy of the Emergency Response Plan in affect at the Facility to the Department.

105. **Prior to August 27, 2004,** the Approval Holder shall submit to the Department a report detailing the results of the leachate video, or approved alternative, inspection of the leachate collection system. A report shall be submitted no later then 2 months after completion of all additional inspections of the leachate collection system.

106. **Prior to August 27, 2004,** the Approval Holder shall submit to the Department an interim leachate management plan that clearly indicates how the Facility plans on managing the additional leachate created when cell 4 becomes operational.

107. **Prior to August 4, 2006,** the Approval Holder shall submit to the Department a copy of the Monitoring Program Review.

108. **Prior to November 30 of each year,** the Approval Holder shall submit a Domestic Well Monitoring Program report to the Department of Health and Wellness. The report as a minimum shall include:
- a signed copy of the analysis results; and
- a summary by a qualified person of each well highlighting any concerns or potential problems found in the analysis.

A letter shall also be sent to the Department prior to November 30 of each year indicating that the sampling and analysis has been completed and that a report has been forwarded to the Department of Health and Wellness.

109. **Prior to November 30 of each year,** the Approval Holder shall ensure that each homeowner that has their well sampled as part of the Domestic Well Monitoring Program receives a signed copy of the analysis from the laboratory that did the analysis and a summary sheet that highlights any concerns or potential problems found in the analysis.

110. **Within 30 days of the end of each Quarter**, the Approval Holder shall submit a report to the Department that includes a copy of all the monitoring analyses required by the Facility from the previous quarter in a form agreeable to the Director. Any immediate environmental concerns related to the sampling results must be highlighted in a summary page. The report shall also include:
- Tabulated readings detailing the leachate level in the disposal cells;
- Copies of the analyses and the cumulative weighted averages of the permeate;

111. **By March 31 of each year**, the Approval Holder shall submit an annual report to the Department. The report shall include but not necessarily be limited to:
- A copy of all the sampling and monitoring data obtained by the Facility to date;
- Analysis of the groundwater monitoring data by a qualified independent third part that includes commentary on any potential impacts and recommendations for future monitoring and remediation of any potential environmental impacts;
- The conductivity readings obtained at the permeate discharge for the last several months including a monthly average/summary;
- A copy of the "Asbestos Disposal Record"; and
- A summary of daily precipitation data obtained from the nearest reporting station.

E. ENVIRONMENTAL EMERGENCY REPORTING SYSTEM:

112. The Approval Holder shall ensure that an Environmental Protection Plan is prepared to mitigate and respond to emergency situations that may arise at the Facility, that includes but is not necessarily limited to, spills or an unauthorized discharge of leachate, oil, hazardous waste or dangerous materials; forest fires, traffic accidents; or the failure of retention ponds or the leachate collection systems.

113. The Approval Holder shall ensure that the Region 4 (Saint John) Office and Director are notified within 24 hours of any public complaint received at the Facility.

114. The Approval Holder, operator or any person in charge of the Facility **shall immediately** notify the Department where:

i) there has been, or is likely to be, an unauthorized release of solid, liquid or gaseous material including leachate, wastewater, petroleum or hazardous materials, to the soil, surface water, groundwater or atmosphere;
ii) there has been a violation or prohibited occurrence of the *Water Quality Regulation* or any Approval issued thereunder;
iii) a release of a contaminant or contaminants is of such magnitude or duration that there is a concern for the health or safety of the public, or there could be an impact to the environment; or
iv) the upset condition has resulted in a public complaint to the Facility.

Notification Procedure

Verbal notification should be made with an inspector at the **Region 4 (Saint John) Office at 658-2558**. If contact cannot be made for any reason the problem should immediately be reported to the **Canadian Coast Guard at 1-800-565-1633**.

Within 24 hours of the original notification, a copy of an "Incident Report" shall be faxed to the Region 4 (Saint John) Office at 658-3046 and also to Central Office in Fredericton at 453-2390. The "Incident Report" shall clearly detail as much information about the incident that is available at the time.

Within five (5) working days from the original notification, a faxed or emailed "Detailed Emergency Report" shall be sent to the Region 4 (Saint John) Office and also to Central Office in Fredericton. The "Detailed Emergency Report" shall describe in detail the problem that occurred, why the problem occurred, what the environmental impact was, what was done to minimize such impact, and what measures have been taken to prevent a re-occurrence of the problem.

Prepared by: Kevin Gould

Kevin Gould, P.Eng
Solid Waste Engineer
Stewardship Branch

Schedule "B"

New Brunswick Department of the Environment and Local Government
Draft Guideline for:

PITS and QUARRIES

This guideline applies to all facilities involved in the blasting, excavation, crushing, washing, screening, storage and/or trucking of non-mineral consolidated rock, sand or gravel and which do not have an Approval to Operate. All operations must comply with the Air Quality Regulation, the Water Quality Regulation, the Watercourse Alteration Regulation, and the Petroleum Storage Regulation, as well as all applicable Municipal Bylaws.

In addition, the following standards are recommended:

(1) **SITING:**
These siting requirements are intended for new operations only. The relocation of existing operations is not required unless the current location poses an unacceptable environmental risk that cannot be satisfactorily reduced by design or operational modifications:

Suggested minimum clearances are outlined below:

RECOMMENDED MINIMUM SETBACK DISTANCES:			
FROM:		IF BLASTING:	IF NO BLASTING:
1.	Operation to residential dwelling	500 meters	100 meters
2.	Operation to property boundary	30	30
3.	Operation to watercourse	30	30
4.	Onsite storage piles to site boundary	30	30
5.	Operation to public road	100	30
6.	Operation to public drinking water source	1000	500
7.	Other clearances on a case by case basis		

(2) **BLASTING:**
The Blasting Code Approval Regulation of the Municipalities Act shall be followed for all blasting.

(3) **SILTATION CONTROL:**
If possible, the operation shall be designed and operated so that there is no liquid discharge.

If this is not possible, effluent may be discharged to the environment from the operation if it contains:
(a) less than 25 ppm suspended solids;
(b) a pH between than 6.0 and 9.5;
(c) there are no other deleterious substances in the discharge;
(d) the discharge does not impact down gradient landowners.

A settling pond may be required to meet these limits. It is the responsibility of the proponent to ensure that the limits of Section 3 are met.

(4) **AIR EMISSIONS:**

The particulate emissions from process equipment or fugitive dust from storage piles, vehicle traffic, or other activities associated with the operation, shall be limited or controlled such that they do not cause substantial loss of enjoyment of the normal use of any property, substantial interference with the normal conduct of any business, or cause damage to property. On a case by case basis, dust emissions may be limited to:

(a) 100 mg/m^3 at the dust collection device outlet; or
(b) no visible dust at the property line.

This may require that process equipment be operated within an enclosed space or equipped with dust collectors or showers.

At the request of an Environmental Inspector, watering or paving shall control road dust from vehicle and equipment traffic on the property. Control by dust suppressants, such as calcium chloride or other, must be approved by the Department of the Environment and Local Government. Dust control by the application of oil is illegal in New Brunswick.

(5) **NOISE:**

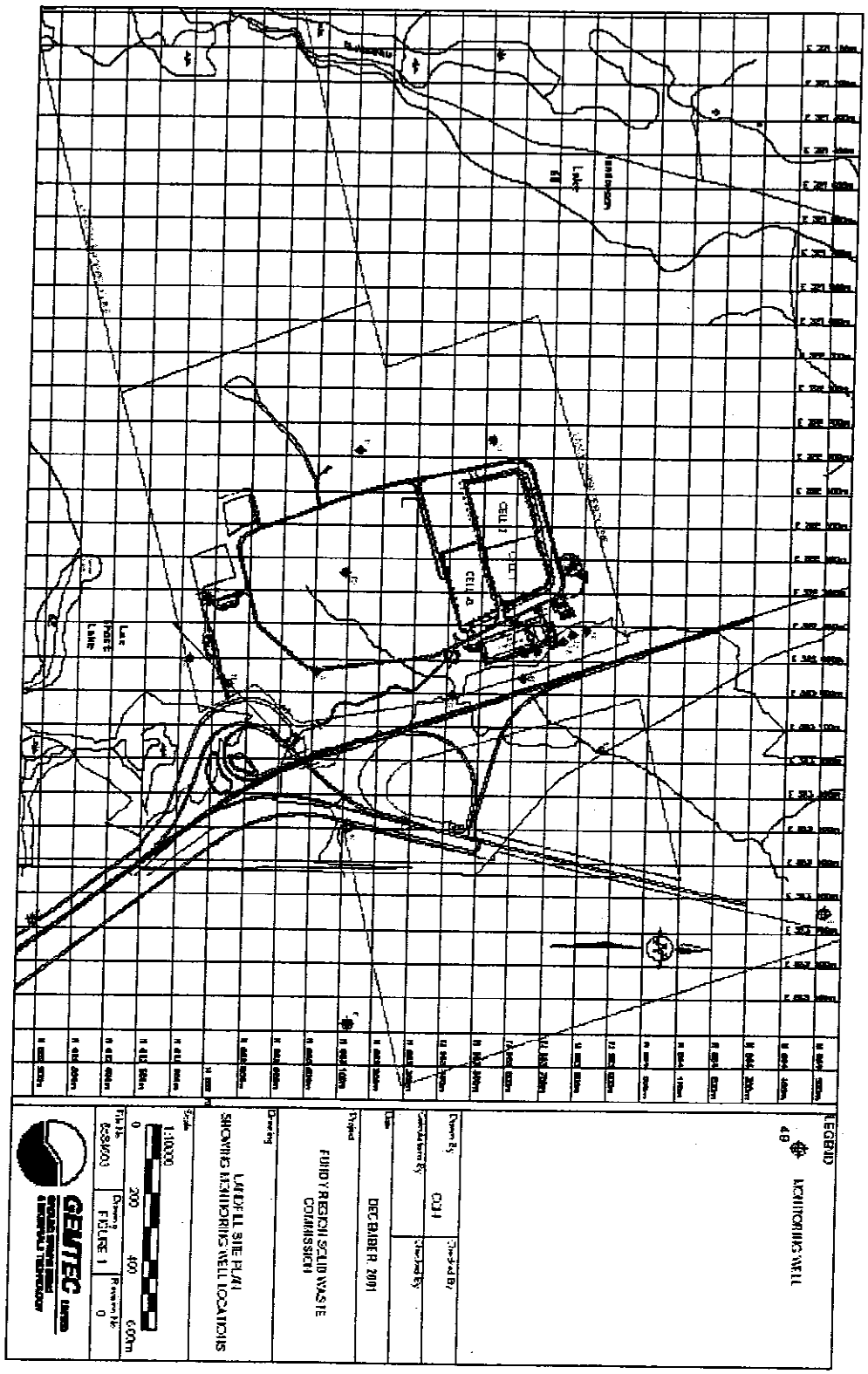
Noise or concussion from any process equipment and/or vehicle traffic, shall be of such a nature that they do not cause substantial loss of enjoyment of the normal use of any property, substantial interference with the normal conduct of any business, or cause damage to property.

On a case by case basis, noise may be limited to:

TIME	MAXIMUM INCREASE in SOUND LEVEL at RECEPTOR
Day: 08:00 to 18:00	12 dB over background
Evening: 18:00 to 24:00 and 0700 to 0800	10 dB over background
Night: 0000 to 07:00	8 dB over background

Schedule "C"

Site Map



Schedule "D"
Pest Control
at
NB Landfill Sites and Transfer Stations

Use Limitations

"Treated baits must be placed in locations not accessible to children, pets, domestic animals, wildlife or in tamper proof bait stations. Do not place bait in areas where there is a possibility of contaminating food or that come in direct contact with food."

If a facility is contracting a professional pest control company to conduct a rodent control program, tamper resistant bait stations may be one component of the control program. The following recommendations are proposed for a rodent control program at these sites.

1 The company must hold a valid Provincial Operator's License and Pesticide Use Permit.

2 All personal directly involved in the mixing, loading and application of the pesticides for the control of rodents at facilities must hold a valid Class F Pesticide Applicator's Certificate, which must be in their immediate possession.

3 The treatment area must be posted with an approved sign prior to the treatment.

4 The signs are to be conspicuously posted at all ordinary points of access.

5 The applicator shall ensure that the signs are removed after either the completion of treatment or the expiration of their permit.

6 The sign shall be rectangular in shape with a minimum size of 14 cm x 21 cm, rain resistant with type or letters or sufficient size and clarity to be easily read together with a symbol of a cautionary raised hand inside a symbol of a stop sign. The information on the sign must be bilingual and must contain the words "Attention", Pesticide Application", the name of the pesticide, the Pest Control Product registration number, date of application, name of applicator, operator name or logo and telephone number.

7 Industry approved tamper resistant bait stations must be attempted before using other methods of baiting.

8 The Director of Pesticides Control or any member of the Pesticides Management Unit must approve areas that require alternative baiting methods.

January 23, 2002

APPENDIX B

LEACHATE LEVELS IN THE CELLS

FRSWC Cell Levels 1998

Date	Cell Level Inches
14-May-98	36.6
15-May-98	38.2
16-May-98	27.6
17-May-98	
18-May-98	40.2
19-May-98	43.7
20-May-98	45.7
21-May-98	47.6
22-May-98	48.4
23-May-98	49.6
24-May-98	
25-May-98	51.2
26-May-98	52.0
27-May-98	52.4
28-May-98	52.8
29-May-98	53.5
30-May-98	53.9
31-May-98	
1-Jun-98	55.1
2-Jun-98	55.9
3-Jun-98	51.6
4-Jun-98	45.7
5-Jun-98	25.2
6-Jun-98	35.4
7-Jun-98	
8-Jun-98	43.7
9-Jun-98	45.7
10-Jun-98	47.2
11-Jun-98	48.4
12-Jun-98	48.8
13-Jun-98	
14-Jun-98	
15-Jun-98	51.1
16-Jun-98	49.6
17-Jun-98	45.7
18-Jun-98	47.2
19-Jun-98	29.5
20-Jun-98	
21-Jun-98	
22-Jun-98	33.5
23-Jun-98	41.3
24-Jun-98	43.7
25-Jun-98	45.3
26-Jun-98	47.2
27-Jun-98	
28-Jun-98	

Date	Cell Level Inches
29-Jun-98	55.9
30-Jun-98	56.7
1-Jul-98	
2-Jul-98	59.4
3-Jul-98	59.4
4-Jul-98	59.8
5-Jul-98	
6-Jul-98	60.6
7-Jul-98	61.4
8-Jul-98	
9-Jul-98	62.6
10-Jul-98	61.0
11-Jul-98	60.2
12-Jul-98	
13-Jul-98	60.2
14-Jul-98	59.4
15-Jul-98	58.3
16-Jul-98	57.5
17-Jul-98	55.5
18-Jul-98	52.4
19-Jul-98	55.5
20-Jul-98	52.0
21-Jul-98	52.0
22-Jul-98	48.8
23-Jul-98	22.8
24-Jul-98	27.6
25-Jul-98	31.9
26-Jul-98	
27-Jul-98	38.6
28-Jul-98	40.1
29-Jul-98	42.5
30-Jul-98	12.2
31-Jul-98	10.6
1-Aug-98	
2-Aug-98	
3-Aug-98	
4-Aug-98	39.0
5-Aug-98	17.7
6-Aug-98	18.1
7-Aug-98	16.5
8-Aug-98	21.2
9-Aug-98	
10-Aug-98	29.1
11-Aug-98	12.2
12-Aug-98	53.5
13-Aug-98	35.4

Date	Cell Level Inches
14-Aug-98	23.6
15-Aug-98	28.0
16-Aug-98	63.3
17-Aug-98	66.9
18-Aug-98	65.7
19-Aug-98	19.7
20-Aug-98	33.1
21-Aug-98	37.8
22-Aug-98	42.1
23-Aug-98	
24-Aug-98	45.7
25-Aug-98	33.1
26-Aug-98	37.4
27-Aug-98	38.9
28-Aug-98	16.1
29-Aug-98	22.4
30-Aug-98	
31-Aug-98	17.3
1-Sep-98	25.6
2-Sep-98	22.0
3-Sep-98	23.2
4-Sep-98	16.9
5-Sep-98	22.4
6-Sep-98	
7-Sep-98	31.9
8-Sep-98	25.4
9-Sep-98	50.4
10-Sep-98	22.0
11-Sep-98	20.3
12-Sep-98	35.1
13-Sep-98	
14-Sep-98	
15-Sep-98	
16-Sep-98	
17-Sep-98	
18-Sep-98	
19-Sep-98	
20-Sep-98	
21-Sep-98	
22-Sep-98	41.7
23-Sep-98	68.1
24-Sep-98	40.0
25-Sep-98	47.2
26-Sep-98	17.7
27-Sep-98	
28-Sep-98	57.5

FRSWC Cell Levels 1998

Date	Cell Level Inches
29-Sep-98	52.4
30-Sep-98	32.7
1-Oct-98	56.3
2-Oct-98	52.8
3-Oct-98	
4-Oct-98	
5-Oct-98	56.7
6-Oct-98	40.2
7-Oct-98	38.9
8-Oct-98	36.2
9-Oct-98	48.4
10-Oct-98	36.6
11-Oct-98	
12-Oct-98	
13-Oct-98	62.6
14-Oct-98	54.3
15-Oct-98	58.7
16-Oct-98	62.6
17-Oct-98	67.8
18-Oct-98	
19-Oct-98	60.6
20-Oct-98	62.9
21-Oct-98	64.9
22-Oct-98	63.4
23-Oct-98	61.8
24-Oct-98	
25-Oct-98	
26-Oct-98	56.7
27-Oct-98	46.8
28-Oct-98	55.5
29-Oct-98	66.5
30-Oct-98	69.7
31-Oct-98	61.8
1-Nov-98	61.0
2-Nov-98	55.9
3-Nov-98	23.2
4-Nov-98	39.4
5-Nov-98	79.5
6-Nov-98	59.4
7-Nov-98	
8-Nov-98	
9-Nov-98	31.1
10-Nov-98	29.9
11-Nov-98	76.8
12-Nov-98	76.4
13-Nov-98	72.8

Date	Cell Level Inches
14-Nov-98	
15-Nov-98	61.0
16-Nov-98	57.5
17-Nov-98	60.6
18-Nov-98	57.5
19-Nov-98	63.4
20-Nov-98	60.6
21-Nov-98	55.5
22-Nov-98	
23-Nov-98	52.4
24-Nov-98	57.5
25-Nov-98	42.5
26-Nov-98	19.2
27-Nov-98	67.7
28-Nov-98	70.5
29-Nov-98	67.7
30-Nov-98	68.1
1-Dec-98	65.7
2-Dec-98	63.4
3-Dec-98	59.4
4-Dec-98	55.9
5-Dec-98	
6-Dec-98	
7-Dec-98	20.1
8-Dec-98	16.5
9-Dec-98	16.9
10-Dec-98	20.5
11-Dec-98	22.8
12-Dec-98	
13-Dec-98	
14-Dec-98	24.0
15-Dec-98	16.5
16-Dec-98	18.9
17-Dec-98	19.0
18-Dec-98	18.9
19-Dec-98	
20-Dec-98	
21-Dec-98	18.9
22-Dec-98	60.6
23-Dec-98	80.7
24-Dec-98	80.7
25-Dec-98	
26-Dec-98	83.5
27-Dec-98	76.4
28-Dec-98	66.1
29-Dec-98	54.7

Date	Cell Level Inches
30-Dec-98	
31-Dec-98	18.9

Leachate Data

Date	Cell Level Inches
4-Jan-99	80.4
5-Jan-99	77.8
6-Jan-99	72.3
7-Jan-99	69.8
8-Jan-99	52.7
9-Jan-99	60.4
10-Jan-99	93.7
11-Jan-99	97.4
12-Jan-99	91.4
13-Jan-99	90.0
14-Jan-99	79.8
15-Jan-99	59.8
16-Jan-99	98.0
17-Jan-99	90.7
18-Jan-99	83.7
19-Jan-99	87.0
20-Jan-99	80.4
21-Jan-99	70.1
22-Jan-99	59.7
25-Jan-99	69.9
26-Jan-99	75.0
27-Jan-99	74.1
28-Jan-99	72.1
29-Jan-99	70.9
1-Feb-99	59.2
2-Feb-99	59.2
3-Feb-99	83.2
4-Feb-99	93.2
5-Feb-99	88.2
8-Feb-99	74.2
9-Feb-99	73.3
10-Feb-99	67.3
11-Feb-99	61.3
12-Feb-99	57.1
13-Feb-99	66.3
15-Feb-99	73.4
16-Feb-99	71.3
17-Feb-99	66.6
18-Feb-99	62.1
19-Feb-99	74.4
22-Feb-99	86.3
23-Feb-99	87.4
24-Feb-99	86.1
25-Feb-99	83.0
26-Feb-99	82.0
1-Mar-99	77.1

Date	Cell Level Inches
2-Mar-99	94.1
3-Mar-99	98.1
4-Mar-99	96.8
5-Mar-99	97.4
8-Mar-99	94.4
9-Mar-99	95.4
10-Mar-99	89.6
11-Mar-99	85.1
12-Mar-99	85.1
15-Mar-99	95.4
16-Mar-99	98.4
17-Mar-99	91.5
18-Mar-99	80.1
19-Mar-99	59.4
20-Mar-99	59.8
22-Mar-99	60.4
23-Mar-99	92.0
24-Mar-99	99.9
25-Mar-99	108.0
26-Mar-99	108.1
28-Mar-99	92.4
29-Mar-99	93.4
30-Mar-99	97.8
31-Mar-99	94.4
1-Apr-99	97.4
5-Apr-99	98.5
6-Apr-99	83.1
7-Apr-99	76.4
8-Apr-99	56.7
9-Apr-99	57.1
10-Apr-99	56.4
12-Apr-99	62.0
13-Apr-99	58.4
14-Apr-99	51.0
15-Apr-99	35.4
16-Apr-99	35.4
19-Apr-99	24.4
20-Apr-99	26.1
21-Apr-99	22.3
22-Apr-99	25.0
23-Apr-99	24.7
26-Apr-99	27.1
27-Apr-99	21.2
28-Apr-99	25.0
29-Apr-99	24.1
30-Apr-99	26.2

Date	Cell Level Inches
6-May-99	27.2
7-May-99	24.3
10-May-99	22.1
11-May-99	23.7
12-May-99	25.1
13-May-99	23.7
14-May-99	26.2
17-May-99	23.7
18-May-99	26.3
19-May-99	23.3
20-May-99	27.2
21-May-99	81.3
22-May-99	90.0
25-May-99	95.0
26-May-99	100.0
27-May-99	94.5
28-May-99	90.7
31-May-99	74.5
1-Jun-99	75.9
2-Jun-99	71.3
3-Jun-99	70.3
4-Jun-99	68.4
7-Jun-99	60.4
9-Jun-99	62.4
10-Jun-99	66.2
11-Jun-99	66.2
14-Jun-99	63.7
15-Jun-99	64.2
16-Jun-99	61.3
17-Jun-99	59.7
18-Jun-99	58.1
21-Jun-99	25.3
22-Jun-99	26.1
23-Jun-99	25.4
24-Jun-99	23.7
25-Jun-99	26.1
28-Jun-99	26.1
29-Jun-99	24.3
30-Jun-99	26.9
2-Jul-99	25.6
5-Jul-99	26.2
6-Jul-99	24.9
7-Jul-99	26.3
8-Jul-99	28.3
9-Jul-99	23.2
12-Jul-99	54.6

Leachate Data

Date	Cell Level Inches
13-Jul-99	38.8
14-Jul-99	55.2
15-Jul-99	27.9
16-Jul-99	23.7
19-Jul-99	22.9
20-Jul-99	26.1
21-Jul-99	23.4
22-Jul-99	28.0
23-Jul-99	23.7
26-Jul-99	24.1
27-Jul-99	26.4
28-Jul-99	26.8
29-Jul-99	65.3
30-Jul-99	65.0
3-Aug-99	77.0
4-Aug-99	72.2
5-Aug-99	65.3
6-Aug-99	64.1
9-Aug-99	82.3
10-Aug-99	91.4
11-Aug-99	91.5
12-Aug-99	91.0
13-Aug-99	91.0
16-Aug-99	101.0
17-Aug-99	101.8
18-Aug-99	94.3
19-Aug-99	92.0
20-Aug-99	90.8
23-Aug-99	82.6
24-Aug-99	83.5
25-Aug-99	85.4
26-Aug-99	84.6
27-Aug-99	82.9
30-Aug-99	76.4
31-Aug-99	66.9
1-Sep-99	60.7
2-Sep-99	56.9
3-Sep-99	56.0
7-Sep-99	61.2
8-Sep-99	50.2
9-Sep-99	50.7
10-Sep-99	44.6
13-Sep-99	33.6
14-Sep-99	27.7
15-Sep-99	31.0
16-Sep-99	27.8

Date	Cell Level Inches
17-Sep-99	79.0
20-Sep-99	89.0
21-Sep-99	90.0
22-Sep-99	96.1
23-Sep-99	114.1
24-Sep-99	112.1
25-Sep-99	94.6
26-Sep-99	91.6
27-Sep-99	86.9
28-Sep-99	88.6
29-Sep-99	89.4
30-Sep-99	91.0
1-Oct-99	89.7
4-Oct-99	85.3
5-Oct-99	85.5
6-Oct-99	86.4
7-Oct-99	86.6
8-Oct-99	84.7
12-Oct-99	83.8
13-Oct-99	81.7
14-Oct-99	92.4
15-Oct-99	97.8
18-Oct-99	104.4
19-Oct-99	101.7
20-Oct-99	100.1
21-Oct-99	99.2
22-Oct-99	97.6
23-Oct-99	91.7
25-Oct-99	95.7
26-Oct-99	95.3
27-Oct-99	95.3
28-Oct-99	94.4
29-Oct-99	94.3
1-Nov-99	95.9
2-Nov-99	96.3
3-Nov-99	96.5
4-Nov-99	101.0
5-Nov-99	98.7
8-Nov-99	95.1
9-Nov-99	93.0
10-Nov-99	93.6
15-Nov-99	89.0
16-Nov-99	95.1
17-Nov-99	97.1
18-Nov-99	95.4
19-Nov-99	95.1

Date	Cell Level Inches
22-Nov-99	93.4
23-Nov-99	95.9
24-Nov-99	94.9
25-Nov-99	96.7
26-Nov-99	96.1
29-Nov-99	100.1
30-Nov-99	102.1
1-Dec-99	100.8
2-Dec-99	100.7
3-Dec-99	100.2
4-Dec-99	97.6
6-Dec-99	95.7
7-Dec-99	93.7
8-Dec-99	104.1
9-Dec-99	104.4
10-Dec-99	95.9
13-Dec-99	94.7

F.R.S.W.C. Leachate Data **2000**

Date	Cell Level Inches
3-Jan-00	73.4
4-Jan-00	77.8
5-Jan-00	93.6
6-Jan-00	102.4
7-Jan-00	102.3
10-Jan-00	97.0
11-Jan-00	96.4
12-Jan-00	98.4
13-Jan-00	93.4
14-Jan-00	89.7
15-Jan-00	85.4
16-Jan-00	85.6
17-Jan-00	85.7
18-Jan-00	84.9
19-Jan-00	83.1
20-Jan-00	83.3
21-Jan-00	83.7
22-Jan-00	84.0
23-Jan-00	84.2
24-Jan-00	84.3
25-Jan-00	84.6
26-Jan-00	94.4
27-Jan-00	101.4
28-Jan-00	101.7
29-Jan-00	96.5
30-Jan-00	85.5
31-Jan-00	96.2
1-Feb-00	89.2
2-Feb-00	84.0
3-Feb-00	81.3
4-Feb-00	79.1
5-Feb-00	76.3
6-Feb-00	75.5
7-Feb-00	76.6
8-Feb-00	75.2
9-Feb-00	72.6
10-Feb-00	76.0
11-Feb-00	76.3
12-Feb-00	76.5
13-Feb-00	86.5
14-Feb-00	86.6
15-Feb-00	112.2
16-Feb-00	110.3
17-Feb-00	101.3
18-Feb-00	94.8
19-Feb-00	86.3

Top of Sump 84.5 Inches

Date	Cell Level Inches
20-Feb-00	82.8
21-Feb-00	81.4
22-Feb-00	84.4
23-Feb-00	85.7
24-Feb-00	95.5
25-Feb-00	102.3
26-Feb-00	102.0
27-Feb-00	102.5
28-Feb-00	112.5
29-Feb-00	111.5
1-Mar-00	106.5
2-Mar-00	98.2
3-Mar-00	86.5
4-Mar-00	85.8
5-Mar-00	84.7
6-Mar-00	82.6
7-Mar-00	82.6
8-Mar-00	81.8
9-Mar-00	81.0
10-Mar-00	80.4
11-Mar-00	80.1
12-Mar-00	86.5
13-Mar-00	106.2
14-Mar-00	100.1
15-Mar-00	92.6
16-Mar-00	89.2
17-Mar-00	86.3
18-Mar-00	85.5
19-Mar-00	87.7
20-Mar-00	88.8
21-Mar-00	85.2
22-Mar-00	82.5
23-Mar-00	80.5
24-Mar-00	85.6
25-Mar-00	88.9
26-Mar-00	90.7
27-Mar-00	91.8
28-Mar-00	86.8
29-Mar-00	89.2
30-Mar-00	97.8
31-Mar-00	85.0
1-Apr-00	80.2
2-Apr-00	75.1
3-Apr-00	75.2
4-Apr-00	74.6
5-Apr-00	77.9

Top of Sump 84.5 Inches

Date	Cell Level Inches
6-Apr-00	86.7
7-Apr-00	83.6
8-Apr-00	82.1
9-Apr-00	82.9
10-Apr-00	85.5
11-Apr-00	83.5
12-Apr-00	83.2
13-Apr-00	83.7
14-Apr-00	82.9
15-Apr-00	82.3
16-Apr-00	81.8
17-Apr-00	81.5
18-Apr-00	79.0
19-Apr-00	76.9
20-Apr-00	71.5
21-Apr-00	65.4
22-Apr-00	60.0
23-Apr-00	60.7
24-Apr-00	62.0
25-Apr-00	62.0
26-Apr-00	52.1
27-Apr-00	51.1
28-Apr-00	30.1
29-Apr-00	29.2
30-Apr-00	33.8
1-May-00	33.3
2-May-00	30.0
3-May-00	52.1
4-May-00	22.4
5-May-00	61.6
6-May-00	36.1
7-May-00	47.7
8-May-00	56.0
9-May-00	27.9
10-May-00	33.1
11-May-00	28.0
12-May-00	32.7
13-May-00	28.2
14-May-00	63.3
15-May-00	31.5
16-May-00	31.0
17-May-00	28.2
18-May-00	31.4
19-May-00	52.6
20-May-00	56.3
21-May-00	61.2

F.R.S.W.C. Leachate Data 2000

Date	Cell Level Inches
22-May-00	61.7
23-May-00	62.0
24-May-00	64.2
25-May-00	67.5
26-May-00	73.7
27-May-00	79.5
28-May-00	86.4
29-May-00	83.5
30-May-00	85.4
31-May-00	83.2
1-Jun-00	81.1
2-Jun-00	79.9
3-Jun-00	77.6
4-Jun-00	74.1
5-Jun-00	72.9
6-Jun-00	62.9
7-Jun-00	59.8
8-Jun-00	56.3
9-Jun-00	52.4
10-Jun-00	40.2
11-Jun-00	28.8
12-Jun-00	31.2
13-Jun-00	28.2
14-Jun-00	32.4
15-Jun-00	31.2
16-Jun-00	33.8
17-Jun-00	36.5
18-Jun-00	43.7
19-Jun-00	55.3
20-Jun-00	33.8
21-Jun-00	28.2
22-Jun-00	30.2
23-Jun-00	30.5
24-Jun-00	33.2
25-Jun-00	32.2
26-Jun-00	31.7
27-Jun-00	33.1
28-Jun-00	33.4
29-Jun-00	33.7
30-Jun-00	31.9
1-Jul-00	39.5
2-Jul-00	44.5
3-Jul-00	48.6
4-Jul-00	52.3
5-Jul-00	57.4
6-Jul-00	33.2

Top of Sump: 31.5 Inches

Date	Cell Level Inches
7-Jul-00	32.1
8-Jul-00	34.6
9-Jul-00	29.7
10-Jul-00	32.0
11-Jul-00	36.4
12-Jul-00	28.7
13-Jul-00	32.5
14-Jul-00	36.4
15-Jul-00	31.5
16-Jul-00	41.2
17-Jul-00	43.2
18-Jul-00	60.3
19-Jul-00	64.2
20-Jul-00	62.5
21-Jul-00	60.1
22-Jul-00	62.4
23-Jul-00	65.4
24-Jul-00	67.1
25-Jul-00	65.4
26-Jul-00	63.4
27-Jul-00	62.1
28-Jul-00	40.2
29-Jul-00	32.6
30-Jul-00	31.5
31-Jul-00	33.0
1-Aug-00	32.4
2-Aug-00	31.9
3-Aug-00	31.6
4-Aug-00	32.5
5-Aug-00	32.6
6-Aug-00	33.2
7-Aug-00	31.8
8-Aug-00	32.5
9-Aug-00	28.6
10-Aug-00	24.5
11-Aug-00	30.9
12-Aug-00	33.1
13-Aug-00	31.7
14-Aug-00	32.4
15-Aug-00	29.5
16-Aug-00	30.3
17-Aug-00	32.5
18-Aug-00	34.0
19-Aug-00	32.9
20-Aug-00	44.5
21-Aug-00	50.2

Top of Liner: 126.0 Inches

Date	Cell Level Inches
22-Aug-00	30.2
23-Aug-00	32.5
24-Aug-00	41.6
25-Aug-00	22.7
26-Aug-00	41.2
27-Aug-00	50.2
28-Aug-00	57.7
29-Aug-00	32.8
30-Aug-00	28.3
31-Aug-00	31.1
1-Sep-00	32.0
2-Sep-00	35.2
3-Sep-00	29.6
4-Sep-00	33.4
5-Sep-00	30.0
6-Sep-00	35.1
7-Sep-00	32.2
8-Sep-00	32.9
9-Sep-00	34.8
10-Sep-00	35.4
11-Sep-00	30.5
12-Sep-00	40.2
13-Sep-00	Pump Maint.
14-Sep-00	Pump Maint.
15-Sep-00	52.4
16-Sep-00	68.7
17-Sep-00	73.3
18-Sep-00	74.9
19-Sep-00	72.2
20-Sep-00	68.4
21-Sep-00	64.3
22-Sep-00	56.2
23-Sep-00	48.0
24-Sep-00	29.6
25-Sep-00	63.2
26-Sep-00	58.1
27-Sep-00	49.4
28-Sep-00	38.2
29-Sep-00	28.4
30-Sep-00	31.5
1-Oct-00	26.1
2-Oct-00	30.7
3-Oct-00	29.8
4-Oct-00	33.4
5-Oct-00	30.2
6-Oct-00	31.5

F.R.S.W.C. Leachate Data **2000**

Date	Cell Level Inches
7-Oct-00	33.4
8-Oct-00	46.2
9-Oct-00	59.3
10-Oct-00	66.4
11-Oct-00	61.9
12-Oct-00	62.0
13-Oct-00	66.4
14-Oct-00	67.1
15-Oct-00	66.4
16-Oct-00	62.3
17-Oct-00	59.2
18-Oct-00	61.2
19-Oct-00	70.2
20-Oct-00	68.7
21-Oct-00	65.8
22-Oct-00	59.6
23-Oct-00	52.5
24-Oct-00	42.9
25-Oct-00	30.7
26-Oct-00	29.2
27-Oct-00	24.3
28-Oct-00	28.4
29-Oct-00	44.1
30-Oct-00	60.0
31-Oct-00	70.1
1-Nov-00	64.8
2-Nov-00	62.4
3-Nov-00	58.4
4-Nov-00	53.8
5-Nov-00	44.4
6-Nov-00	36.2
7-Nov-00	30.4
8-Nov-00	34.2
9-Nov-00	29.0
10-Nov-00	31.5
11-Nov-00	28.6
12-Nov-00	44.9
13-Nov-00	52.3
14-Nov-00	31.9
15-Nov-00	31.2
16-Nov-00	40.5
17-Nov-00	49.2
18-Nov-00	55.4
19-Nov-00	61.1
20-Nov-00	66.1
21-Nov-00	62.3

Date	Cell Level Inches
22-Nov-00	59.5
23-Nov-00	62.0
24-Nov-00	57.5
25-Nov-00	55.2
26-Nov-00	56.8
27-Nov-00	66.2
28-Nov-00	80.0
29-Nov-00	86.4
30-Nov-00	85.3
1-Dec-00	87.2
2-Dec-00	85.2
3-Dec-00	82.5
4-Dec-00	80.0
5-Dec-00	78.4
6-Dec-00	74.1
7-Dec-00	69.7
8-Dec-00	67.2
9-Dec-00	62.3
10-Dec-00	64.1
11-Dec-00	67.4
12-Dec-00	65.3
13-Dec-00	62.3
14-Dec-00	60.1
15-Dec-00	58.7
16-Dec-00	56.2
17-Dec-00	68.3
18-Dec-00	97.7
19-Dec-00	100.1
20-Dec-00	100.0
21-Dec-00	75.6
22-Dec-00	68.9
23-Dec-00	72.3
24-Dec-00	76.9
25-Dec-00	n/a
26-Dec-00	79.1
27-Dec-00	80.0
28-Dec-00	78.3
29-Dec-00	75.6
30-Dec-00	74.8
31-Dec-00	76.8

Date	Cell Level Inches

F.R.S.W.C. Leachate Data 2001

Date	Cell Level Inches
1-Jan-01	78.2
2-Jan-01	78.9
3-Jan-01	74.5
4-Jan-01	71.9
5-Jan-01	68.5
6-Jan-01	66.2
7-Jan-01	69.4
8-Jan-01	70.2
9-Jan-01	69.8
10-Jan-01	68.7
11-Jan-01	68.2
12-Jan-01	67.5
13-Jan-01	67.9
14-Jan-01	68.2
15-Jan-01	70.1
16-Jan-01	68.9
17-Jan-01	68.2
18-Jan-01	68.4
19-Jan-01	67.8
20-Jan-01	69.1
21-Jan-01	67.6
22-Jan-01	68.2
23-Jan-01	69.0
24-Jan-01	70.1
25-Jan-01	68.9
26-Jan-01	63.4
27-Jan-01	63.9
28-Jan-01	58.8
29-Jan-01	60.2
30-Jan-01	35.4
31-Jan-01	30.4
1-Feb-01	34.5
2-Feb-01	34.1
3-Feb-01	34.2
4-Feb-01	33.8
5-Feb-01	30.0
6-Feb-01	33.3
7-Feb-01	33.3
8-Feb-01	34.3
9-Feb-01	31.5
10-Feb-01	34.2
11-Feb-01	61.5
12-Feb-01	60.3
13-Feb-01	61.5
14-Feb-01	34.6
15-Feb-01	35.9

Top of Sump 111.5 Inches

Date	Cell Level Inches
16-Feb-01	35.4
17-Feb-01	32.4
18-Feb-01	33.1
19-Feb-01	35.2
20-Feb-01	34.8
21-Feb-01	30.2
22-Feb-01	33.9
23-Feb-01	35.1
24-Feb-01	30.2
25-Feb-01	31.1
26-Feb-01	35.7
27-Feb-01	35.9
28-Feb-01	35.4
1-Mar-01	34.3
2-Mar-01	35.7
3-Mar-01	44.2
4-Mar-01	57.1
5-Mar-01	58.9
6-Mar-01	49.8
7-Mar-01	47.2
8-Mar-01	47.0
9-Mar-01	51.0
10-Mar-01	33.2
11-Mar-01	47.7
12-Mar-01	57.3
13-Mar-01	31.5
14-Mar-01	62.4
15-Mar-01	69.7
16-Mar-01	69.9
17-Mar-01	66.2
18-Mar-01	72.7
19-Mar-01	76.4
20-Mar-01	77.4
21-Mar-01	85.0
22-Mar-01	84.5
23-Mar-01	83.1
24-Mar-01	81.4
25-Mar-01	78.7
26-Mar-01	78.9
27-Mar-01	72.4
28-Mar-01	68.8
29-Mar-01	70.1
30-Mar-01	72.3
31-Mar-01	75.6
1-Apr-01	76.4
2-Apr-01	77.4

Top of Liner 126.0 Inches

Date	Cell Level Inches
3-Apr-01	72.9
4-Apr-01	75.9
5-Apr-01	82.5
6-Apr-01	89.5
7-Apr-01	87.1
8-Apr-01	83.6
9-Apr-01	87.9
10-Apr-01	87.0
11-Apr-01	86.3
12-Apr-01	83.5
13-Apr-01	81.6
14-Apr-01	93.5
15-Apr-01	99.8
16-Apr-01	97.2
17-Apr-01	94.6
18-Apr-01	92.5
19-Apr-01	89.6
20-Apr-01	87.9
21-Apr-01	88.3
22-Apr-01	91.5
23-Apr-01	98.9
24-Apr-01	94.2
25-Apr-01	89.2
26-Apr-01	81.7
27-Apr-01	73.5
28-Apr-01	72.9
29-Apr-01	72.5
30-Apr-01	73.2
1-May-01	56.7
2-May-01	68.2
3-May-01	67.4
4-May-01	66.5
5-May-01	65.3
6-May-01	-
7-May-01	64.5
8-May-01	61.8
9-May-01	62.3
10-May-01	62.4
11-May-01	60.8
12-May-01	59.1
13-May-01	-
14-May-01	74.3
15-May-01	81.6
16-May-01	84.6
17-May-01	88.9
18-May-01	89.0

F.R.S.W.C. Leachate Data 2001

Date	Cell Level Inches
19-May-01	89.5
20-May-01	-
21-May-01	91.5
22-May-01	88.9
23-May-01	85.6
24-May-01	82.5
25-May-01	79.4
26-May-01	75.2
27-May-01	77.4
28-May-01	76.1
29-May-01	79.3
30-May-01	82.1
31-May-01	82.0
1-Jun-01	81.5
2-Jun-01	80.9
3-Jun-01	-
4-Jun-01	82.3
5-Jun-01	81.7
6-Jun-01	81.2
7-Jun-01	80.9
8-Jun-01	81.2
9-Jun-01	80.8
10-Jun-01	-
11-Jun-01	80.2
12-Jun-01	78.9
13-Jun-01	77.9
14-Jun-01	77.0
15-Jun-01	75.9
16-Jun-01	75.5
17-Jun-01	-
18-Jun-01	78.2
19-Jun-01	77.9
20-Jun-01	77.5
21-Jun-01	77.6
22-Jun-01	78.0
23-Jun-01	77.6
24-Jun-01	-
25-Jun-01	78.4
26-Jun-01	77.5
27-Jun-01	77.2
28-Jun-01	76.2
29-Jun-01	77.1
30-Jun-01	76.2
1-Jul-01	-
2-Jul-01	-
3-Jul-01	75.3

Top of Sump 31.5 Inches

Date	Cell Level Inches
4-Jul-01	74.8
5-Jul-01	74.3
6-Jul-01	74.2
7-Jul-01	73.8
8-Jul-01	-
9-Jul-01	72.9
10-Jul-01	72.3
11-Jul-01	72.1
12-Jul-01	71.5
13-Jul-01	71.3
14-Jul-01	69.2
15-Jul-01	-
16-Jul-01	70.1
17-Jul-01	66.2
18-Jul-01	60.2
19-Jul-01	57.9
20-Jul-01	52.1
21-Jul-01	52.6
22-Jul-01	-
23-Jul-01	54.1
24-Jul-01	46.1
25-Jul-01	28.0
26-Jul-01	31.4
27-Jul-01	30.2
28-Jul-01	26.5
29-Jul-01	-
30-Jul-01	44.1
31-Jul-01	30.5
1-Aug-01	32.5
2-Aug-01	26.1
3-Aug-01	33.1
4-Aug-01	31.5
5-Aug-01	-
6-Aug-01	35.9
7-Aug-01	30.2
8-Aug-01	28.5
9-Aug-01	31.7
10-Aug-01	33.9
11-Aug-01	26.3
12-Aug-01	-
13-Aug-01	54.1
14-Aug-01	57.2
15-Aug-01	60.2
16-Aug-01	56.2
17-Aug-01	63.5
18-Aug-01	60.0

Top of Liner 126.0 Inches

Date	Cell Level Inches
19-Aug-01	-
20-Aug-01	77.1
21-Aug-01	74.1
22-Aug-01	72.0
23-Aug-01	75.2
24-Aug-01	77.1
25-Aug-01	77.2
26-Aug-01	-
27-Aug-01	80.0
28-Aug-01	74.6
29-Aug-01	73.2
30-Aug-01	70.1
31-Aug-01	68.2
1-Sep-01	69.0
2-Sep-01	-
3-Sep-01	77.2
4-Sep-01	79.1
5-Sep-01	81.2
6-Sep-01	82.5
7-Sep-01	82.4
8-Sep-01	81.7
9-Sep-01	-
10-Sep-01	82.5
11-Sep-01	80.0
12-Sep-01	81.4
13-Sep-01	80.2
14-Sep-01	78.6
15-Sep-01	77.6
16-Sep-01	
17-Sep-01	78.1
18-Sep-01	77.2
19-Sep-01	75.5
20-Sep-01	55.2
21-Sep-01	64.9
22-Sep-01	77.8
23-Sep-01	-
24-Sep-01	90.8
25-Sep-01	87.4
26-Sep-01	91.2
27-Sep-01	84.6
28-Sep-01	90.9
29-Sep-01	92.5
30-Sep-01	94.2
1-Oct-01	96.4
2-Oct-01	95.2
3-Oct-01	91.3

F.R.S.W.C. Leachate Data **2001**

Date	Cell Level Inches
4-Oct-01	89.4
5-Oct-01	89.1
6-Oct-01	86.4
7-Oct-01	-
8-Oct-01	87.2
9-Oct-01	83.9
10-Oct-01	79.1
11-Oct-01	74.5
12-Oct-01	80.8
13-Oct-01	79.5
14-Oct-01	-
15-Oct-01	80.9
16-Oct-01	81.6
17-Oct-01	80.2
18-Oct-01	89.9
19-Oct-01	93.4
20-Oct-01	94.2
21-Oct-01	-
22-Oct-01	94.8
23-Oct-01	90.5
24-Oct-01	86.4
25-Oct-01	87.0
26-Oct-01	84.3
27-Oct-01	83.1
28-Oct-01	84.4
29-Oct-01	82.0
30-Oct-01	81.4
31-Oct-01	81.3
1-Nov-01	80.2
2-Nov-01	80.4
3-Nov-01	-
4-Nov-01	-
5-Nov-01	84.5
6-Nov-01	86.5
7-Nov-01	87.2
8-Nov-01	87.0
9-Nov-01	84.5
10-Nov-01	85.2
11-Nov-01	-
12-Nov-01	90.2
13-Nov-01	89.0
14-Nov-01	89.9
15-Nov-01	89.5
16-Nov-01	89.5
17-Nov-01	89.4
18-Nov-01	-

Top of Sump 31.6 Inches

Date	Cell Level Inches
19-Nov-01	89.7
20-Nov-01	89.4
21-Nov-01	87.4
22-Nov-01	88.3
23-Nov-01	86.5
24-Nov-01	85.1
25-Nov-01	-
26-Nov-01	89.6
27-Nov-01	88.1
28-Nov-01	-
29-Nov-01	-
30-Nov-01	86.9
1-Dec-01	87.2
2-Dec-01	-
3-Dec-01	90.3
4-Dec-01	90.1
5-Dec-01	90.3
6-Dec-01	89.8
7-Dec-01	90.5
8-Dec-01	90.2
9-Dec-01	-
10-Dec-01	90.7
11-Dec-01	86.4
12-Dec-01	85.5
13-Dec-01	85.9
14-Dec-01	84.2
15-Dec-01	80.2
16-Dec-01	-
17-Dec-01	80.4
18-Dec-01	78.9
19-Dec-01	79.2
20-Dec-01	77.4
21-Dec-01	78.3
22-Dec-01	74.2
23-Dec-01	-
24-Dec-01	75.6
25-Dec-01	-
26-Dec-01	-
27-Dec-01	77.2
28-Dec-01	77.4
29-Dec-01	69.2
30-Dec-01	-
31-Dec-01	70.2

Top of Liner 126.0 Inches

Date	Cell Level Inches

F.R.S.W.C. Leachate Data 2002

CELL 1&2

Date	Cell Level Inches
1-Jan-02	90.0
2-Jan-02	89.1
3-Jan-02	88.4
4-Jan-02	86.2
5-Jan-02	84.2
6-Jan-02	-
7-Jan-02	81.4
8-Jan-02	64.1
9-Jan-02	65.0
10-Jan-02	60.2
11-Jan-02	56.1
12-Jan-02	-
13-Jan-02	-
14-Jan-02	66.2
15-Jan-02	45.8
16-Jan-02	49.2
17-Jan-02	55.2
18-Jan-02	44.9
19-Jan-02	-
20-Jan-02	-
21-Jan-02	60.5
22-Jan-02	51.2
23-Jan-02	40.2
24-Jan-02	48.2
25-Jan-02	50.2
26-Jan-02	-
27-Jan-02	-
28-Jan-02	62.0
29-Jan-02	66.5
30-Jan-02	66.1
31-Jan-02	66.3
1-Feb-02	65.4
2-Feb-02	-
3-Feb-02	-
4-Feb-02	64.6
5-Feb-02	60.9
6-Feb-02	55.4
7-Feb-02	53.1
8-Feb-02	57.1
9-Feb-02	-
10-Feb-02	-
11-Feb-02	81.3
12-Feb-02	87.4
13-Feb-02	93.1
14-Feb-02	94.0
15-Feb-02	96.2

Date	Cell Level Inches
16-Feb-02	-
17-Feb-02	-
18-Feb-02	106.4
19-Feb-02	102.0
20-Feb-02	102.3
21-Feb-02	103.3
22-Feb-02	108.2
23-Feb-02	-
24-Feb-02	-
25-Feb-02	96.0
26-Feb-02	95.2
27-Feb-02	101.3
28-Feb-02	108.7
1-Mar-02	106.5
2-Mar-02	-
3-Mar-02	-
4-Mar-02	104.2
5-Mar-02	99.7
6-Mar-02	93.1
7-Mar-02	91.9
8-Mar-02	91.5
9-Mar-02	-
10-Mar-02	-
11-Mar-02	94.9
12-Mar-02	94.5
13-Mar-02	93.6
14-Mar-02	93.7
15-Mar-02	93.0
16-Mar-02	92.8
17-Mar-02	-
18-Mar-02	94.2
19-Mar-02	94.7
20-Mar-02	92.1
21-Mar-02	93.5
22-Mar-02	94.2
23-Mar-02	95.0
24-Mar-02	-
25-Mar-02	96.4
26-Mar-02	95.1
27-Mar-02	104.2
28-Mar-02	116.1
29-Mar-02	109.2
30-Mar-02	102.5
31-Mar-02	-
1-Apr-02	105.2
2-Apr-02	112.5

Date	Cell Level Inches
3-Apr-02	106.5
4-Apr-02	105.3
5-Apr-02	100.2
6-Apr-02	97.5
7-Apr-02	-
8-Apr-02	99.0
9-Apr-02	97.2
10-Apr-02	98.8
11-Apr-02	98.6
12-Apr-02	98.5
13-Apr-02	98.2
14-Apr-02	-
15-Apr-02	100.2
16-Apr-02	104.1
17-Apr-02	104.2
18-Apr-02	102.9
19-Apr-02	102.4
20-Apr-02	102.1
21-Apr-02	-
22-Apr-02	99.9
23-Apr-02	98.8
24-Apr-02	97.7
25-Apr-02	98.2
26-Apr-02	99.5
27-Apr-02	-
28-Apr-02	-
29-Apr-02	100.8
30-Apr-02	99.4
1-May-02	102.1
2-May-02	102.5
3-May-02	106.8
4-May-02	-
5-May-02	-
6-May-02	102.8
7-May-02	103.1
8-May-02	101.9
9-May-02	101.3
10-May-02	103.3
11-May-02	-
12-May-02	-
13-May-02	101.3
14-May-02	106
15-May-02	106.2
16-May-02	106
17-May-02	104.9
18-May-02	-

Top of Sump 31.5 inches

Top of Liner 126.0 inches

F.R.S.W.C. Leachate Data 2002

CELL # 1&2

Date	Cell Level Inches
19-May-02	-
20-May-02	102.9
21-May-02	102.9
22-May-02	102.2
23-May-02	103.9
24-May-02	104.2
25-May-02	-
26-May-02	-
27-May-02	98.7
28-May-02	97.5
29-May-02	96.9
30-May-02	97.3
31-May-02	97.0
1-Jun-02	-
2-Jun-02	-
3-Jun-02	88.1
4-Jun-02	86.5
5-Jun-02	86.6
6-Jun-02	86.3
7-Jun-02	85.9
8-Jun-02	-
9-Jun-02	-
10-Jun-02	85.0
11-Jun-02	84.5
12-Jun-02	85.5
13-Jun-02	83.5
14-Jun-02	84.5
15-Jun-02	-
16-Jun-02	-
17-Jun-02	85.8
18-Jun-02	83.5
19-Jun-02	82.9
20-Jun-02	83.0
21-Jun-02	83.3
22-Jun-02	-
23-Jun-02	-
24-Jun-02	84.8
25-Jun-02	83.6
26-Jun-02	82.9
27-Jun-02	85.2
28-Jun-02	83.7
29-Jun-02	-
30-Jun-02	-
1-Jul-02	83.2
2-Jul-02	83.0
3-Jul-02	82.6

Date	Cell Level Inches
4-Jul-02	81.9
5-Jul-02	89.5
6-Jul-02	-
7-Jul-02	-
8-Jul-02	88.5
9-Jul-02	88.9
10-Jul-02	89.1
11-Jul-02	88.6
12-Jul-02	87.9
13-Jul-02	-
14-Jul-02	-
15-Jul-02	88.5
16-Jul-02	99.5
17-Jul-02	89.2
18-Jul-02	84.5
19-Jul-02	84.0
20-Jul-02	-
21-Jul-02	-
22-Jul-02	83.5
23-Jul-02	82.9
24-Jul-02	80.1
25-Jul-02	80.5
26-Jul-02	80.9
27-Jul-02	-
28-Jul-02	-
29-Jul-02	85.0
30-Jul-02	100.1
31-Jul-02	98.0
1-Aug-02	89.1
2-Aug-02	84.5
3-Aug-02	-
4-Aug-02	-
5-Aug-02	82.0
6-Aug-02	81.6
7-Aug-02	84.3
8-Aug-02	82.6
9-Aug-02	81.9
10-Aug-02	-
11-Aug-02	-
12-Aug-02	80.3
13-Aug-02	82.0
14-Aug-02	82.9
15-Aug-02	83.0
16-Aug-02	83.7
17-Aug-02	-
18-Aug-02	-

Date	Cell Level Inches
19-Aug-02	83.4
20-Aug-02	84.3
21-Aug-02	84.2
22-Aug-02	84.2
23-Aug-02	83.9
24-Aug-02	-
25-Aug-02	-
26-Aug-02	81.9
27-Aug-02	80.2
28-Aug-02	81.1
29-Aug-02	81.4
30-Aug-02	80.6
31-Aug-02	-
1-Sep-02	-
2-Sep-02	78.9
3-Sep-02	79.4
4-Sep-02	79.7
5-Sep-02	83.4
6-Sep-02	81.4
7-Sep-02	-
8-Sep-02	-
9-Sep-02	81.4
10-Sep-02	81.1
11-Sep-02	81.1
12-Sep-02	104.7
13-Sep-02	100.4
14-Sep-02	-
15-Sep-02	-
16-Sep-02	99.7
17-Sep-02	104.2
18-Sep-02	101.4
19-Sep-02	100.4
20-Sep-02	99.4
21-Sep-02	-
22-Sep-02	-
23-Sep-02	97.0
24-Sep-02	100.6
25-Sep-02	99.0
26-Sep-02	99.5
27-Sep-02	100.6
28-Sep-02	111.5
29-Sep-02	-
30-Sep-02	112.0
1-Oct-02	111.2
2-Oct-02	108.4
3-Oct-02	108.0

Top of Sump 31.5 inches

Top of Liner 126.0 inches

F.R.S.W.C. Leachate Data 2002

CELL 1&2	
Date	Cell Level Inches
4-Oct-02	107.9
5-Oct-02	-
6-Oct-02	-
7-Oct-02	101.1
8-Oct-02	101.3
9-Oct-02	99.3
10-Oct-02	98.3
11-Oct-02	96.8
12-Oct-02	-
13-Oct-02	-
14-Oct-02	-
15-Oct-02	92.3
16-Oct-02	91.4
17-Oct-02	87.1
18-Oct-02	91.4
19-Oct-02	-
20-Oct-02	-
21-Oct-02	92.7
22-Oct-02	91.7
23-Oct-02	91.1
24-Oct-02	89.1
25-Oct-02	87.9
26-Oct-02	-
27-Oct-02	-
28-Oct-02	92.1
29-Oct-02	92.3
30-Oct-02	91.7
31-Oct-02	93.2
1-Nov-02	93.8
2-Nov-02	-
3-Nov-02	-
4-Nov-02	95.7
5-Nov-02	97.5
6-Nov-02	95.2
7-Nov-02	99.2
8-Nov-02	98.2
9-Nov-02	-
10-Nov-02	105.2
11-Nov-02	106.9
12-Nov-02	105.9
13-Nov-02	109.3
14-Nov-02	101.3
15-Nov-02	97.4
16-Nov-02	-
17-Nov-02	-
18-Nov-02	106.2
19-Nov-02	109.5
20-Nov-02	110.0
21-Nov-02	109.7
22-Nov-02	110.2
23-Nov-02	120.9
24-Nov-02	113.9
25-Nov-02	108.2
26-Nov-02	107.1
27-Nov-02	105.8
28-Nov-02	104.6
29-Nov-02	102.4
30-Nov-02	-
1-Dec-02	104.9
2-Dec-02	105.0
3-Dec-02	105.4
4-Dec-02	105.2
5-Dec-02	105.0
6-Dec-02	104.7
7-Dec-02	-
8-Dec-02	-
9-Dec-02	103.4
10-Dec-02	103.8
11-Dec-02	104.2
12-Dec-02	104.5
13-Dec-02	104.7
14-Dec-02	119.6
15-Dec-02	118.9
16-Dec-02	115.6
17-Dec-02	114.2
18-Dec-02	111.3
19-Dec-02	108.0
20-Dec-02	119.2
21-Dec-02	118.1
22-Dec-02	116.0
23-Dec-02	113.6
24-Dec-02	107.9
25-Dec-02	-
26-Dec-02	-
27-Dec-02	105.6
28-Dec-02	-
29-Dec-02	-
30-Dec-02	102.3
31-Dec-02	99.7

Date	Cell Level Inches

Top of Sump 31.5 inches

Top of Liner 126.0 inches

F.R.S.W.C.

Leachate Data

2002

CELL 3

Date	Cell Level Inches
19-May-02	
20-May-02	
21-May-02	
22-May-02	
23-May-02	
24-May-02	
25-May-02	
26-May-02	
27-May-02	
28-May-02	
29-May-02	
30-May-02	
31-May-02	
1-Jun-02	
2-Jun-02	
3-Jun-02	
4-Jun-02	
5-Jun-02	
6-Jun-02	
7-Jun-02	
8-Jun-02	
9-Jun-02	
10-Jun-02	
11-Jun-02	
12-Jun-02	
13-Jun-02	
14-Jun-02	
15-Jun-02	
16-Jun-02	
17-Jun-02	
18-Jun-02	36.3
19-Jun-02	40
20-Jun-02	41.2
21-Jun-02	41.2
22-Jun-02	-
23-Jun-02	-
24-Jun-02	44.5
25-Jun-02	44.3
26-Jun-02	42.9
27-Jun-02	41.2
28-Jun-02	41.1
29-Jun-02	-
30-Jun-02	-
1-Jul-02	44.9
2-Jul-02	45.9
3-Jul-02	44.7

Date	Cell Level Inches
4-Jul-02	41.6
5-Jul-02	60
6-Jul-02	-
7-Jul-02	-
8-Jul-02	62.7
9-Jul-02	62.5
10-Jul-02	63.2
11-Jul-02	61.8
12-Jul-02	61.3
13-Jul-02	-
14-Jul-02	-
15-Jul-02	62.1
16-Jul-02	65.4
17-Jul-02	64.3
18-Jul-02	61.3
19-Jul-02	59.6
20-Jul-02	-
21-Jul-02	-
22-Jul-02	59.4
23-Jul-02	58.8
24-Jul-02	56.9
25-Jul-02	55.9
26-Jul-02	56.2
27-Jul-02	-
28-Jul-02	-
29-Jul-02	57.9
30-Jul-02	75.5
31-Jul-02	75.0
1-Aug-02	73.0
2-Aug-02	71.1
3-Aug-02	-
4-Aug-02	-
5-Aug-02	71.3
6-Aug-02	69.0
7-Aug-02	70
8-Aug-02	69.4
9-Aug-02	68.5
10-Aug-02	-
11-Aug-02	-
12-Aug-02	65.5
13-Aug-02	65.8
14-Aug-02	65.2
15-Aug-02	65.2
16-Aug-02	64.1
17-Aug-02	-
18-Aug-02	-

Date	Cell Level Inches
19-Aug-02	61.9
20-Aug-02	61.9
21-Aug-02	62.1
22-Aug-02	62.2
23-Aug-02	60.8
24-Aug-02	-
25-Aug-02	-
26-Aug-02	56.5
27-Aug-02	54.8
28-Aug-02	52.9
29-Aug-02	51.3
30-Aug-02	50.4
31-Aug-02	-
1-Sep-02	-
2-Sep-02	-
3-Sep-02	43.3
4-Sep-02	38.0
5-Sep-02	54
6-Sep-02	55.5
7-Sep-02	-
8-Sep-02	-
9-Sep-02	49.5
10-Sep-02	47.4
11-Sep-02	47.0
12-Sep-02	78.9
13-Sep-02	77.7
14-Sep-02	76.2
15-Sep-02	-
16-Sep-02	79.3
17-Sep-02	79.6
18-Sep-02	77
19-Sep-02	75.8
20-Sep-02	73.8
21-Sep-02	73.4
22-Sep-02	-
23-Sep-02	68.9
24-Sep-02	70.5
25-Sep-02	69.3
26-Sep-02	71.5
27-Sep-02	76.2
28-Sep-02	-
29-Sep-02	-
30-Sep-02	81.6
1-Oct-02	76.6
2-Oct-02	73.2
3-Oct-02	70.5

Bottom of sump 0 inches

Top of Liner 126.0 inches

F.R.S.W.C. Leachate Data 2002

CELL 3

Date	Cell Level Inches
4-Oct-02	68.5
5-Oct-02	-
6-Oct-02	-
7-Oct-02	64.4
8-Oct-02	61.3
9-Oct-02	57.8
10-Oct-02	51.7
11-Oct-02	46.3
12-Oct-02	-
13-Oct-02	-
14-Oct-02	39.4
15-Oct-02	35
16-Oct-02	36.1
17-Oct-02	43.5
18-Oct-02	43.9
19-Oct-02	41.8
20-Oct-02	-
21-Oct-02	50
22-Oct-02	48.3
23-Oct-02	44.9
24-Oct-02	38.5
25-Oct-02	28.8
26-Oct-02	-
27-Oct-02	-
28-Oct-02	54.9
29-Oct-02	55.9
30-Oct-02	53.9
31-Oct-02	55.9
1-Nov-02	56.6
2-Nov-02	-
3-Nov-02	-
4-Nov-02	51.1
5-Nov-02	53
6-Nov-02	51.0
7-Nov-02	52.4
8-Nov-02	54.1
9-Nov-02	-
10-Nov-02	-
11-Nov-02	-
12-Nov-02	67.7
13-Nov-02	69.6
14-Nov-02	75.9
15-Nov-02	74.6
16-Nov-02	-
17-Nov-02	-
18-Nov-02	74.3

Date	
19-Nov-02	79.3
20-Nov-02	78.0
21-Nov-02	76.5
22-Nov-02	74.3
23-Nov-02	-
24-Nov-02	84
25-Nov-02	85.2
26-Nov-02	81.5
27-Nov-02	78.5
28-Nov-02	76
29-Nov-02	74.2
30-Nov-02	-
1-Dec-02	-
2-Dec-02	77.0
3-Dec-02	77.8
4-Dec-02	77.3
5-Dec-02	75.5
6-Dec-02	74.5
7-Dec-02	-
8-Dec-02	-
9-Dec-02	72.4
10-Dec-02	71.4
11-Dec-02	70.2
12-Dec-02	68.1
13-Dec-02	72.1
14-Dec-02	-
15-Dec-02	93.3
16-Dec-02	-
17-Dec-02	95.4
18-Dec-02	92.7
19-Dec-02	92.0
20-Dec-02	88.7
21-Dec-02	89.4
22-Dec-02	99.1
23-Dec-02	95.9
24-Dec-02	93.9
25-Dec-02	-
26-Dec-02	93.0
27-Dec-02	92.8
28-Dec-02	90.8
29-Dec-02	99.8
30-Dec-02	85.8
31-Dec-02	82.3

Date	Cell Level Inches

Bottom of sump 0 inches **Top of liner 126.0 inches**

F.R.S.W.C.

Leachate Data

2003

CELL	1&2
Date	Cell Level Inches
1-Jan-03	
2-Jan-03	
3-Jan-03	
4-Jan-03	
5-Jan-03	
6-Jan-03	
7-Jan-03	
8-Jan-03	
9-Jan-03	
10-Jan-03	
11-Jan-03	
12-Jan-03	
13-Jan-03	
14-Jan-03	89.4
15-Jan-03	88.2
16-Jan-03	87.0
17-Jan-03	86.2
18-Jan-03	83.6
19-Jan-03	
20-Jan-03	86.2
21-Jan-03	85.9
22-Jan-03	85.5
23-Jan-03	84.4
24-Jan-03	83.4
25-Jan-03	
26-Jan-03	
27-Jan-03	84.6
28-Jan-03	85.3
29-Jan-03	85.9
30-Jan-03	83.5
31-Jan-03	82.7
1-Feb-03	
2-Feb-03	
3-Feb-03	87.3
4-Feb-03	87.5
5-Feb-03	91.1
6-Feb-03	89.2
7-Feb-03	88.8
8-Feb-03	
9-Feb-03	
10-Feb-03	91.5
11-Feb-03	90.6
12-Feb-03	88.0
13-Feb-03	87.2
14-Feb-03	85.4
15-Feb-03	

Top of Sump 31.5 inches

Date	Cell Level Inches
16-Feb-03	
17-Feb-03	88.6
18-Feb-03	84.6
19-Feb-03	80.4
20-Feb-03	75.8
21-Feb-03	70.0
22-Feb-03	65.1
23-Feb-03	62.6
24-Feb-03	69.2
25-Feb-03	63.7
26-Feb-03	57.9
27-Feb-03	38.4
28-Feb-03	39.5
1-Mar-03	
2-Mar-03	
3-Mar-03	68.1
4-Mar-03	75.7
5-Mar-03	77.0
6-Mar-03	75.0
7-Mar-03	73.6
8-Mar-03	
9-Mar-03	
10-Mar-03	79.4
11-Mar-03	81.0
12-Mar-03	77.9
13-Mar-03	68.2
14-Mar-03	56.4
15-Mar-03	
16-Mar-03	
17-Mar-03	49.2
18-Mar-03	39.7
19-Mar-03	50.1
20-Mar-03	56.2
21-Mar-03	57.2
22-Mar-03	
23-Mar-03	
24-Mar-03	109.1
25-Mar-03	112.4
26-Mar-03	112.1
27-Mar-03	114.1
28-Mar-03	111.1
29-Mar-03	105.5
30-Mar-03	98.9
31-Mar-03	120.6
1-Apr-03	109.6
2-Apr-03	76.1

Top of Liner 126.0 inches

Date	Cell Level Inches
3-Apr-03	66.8
4-Apr-03	59.0
5-Apr-03	62.4
6-Apr-03	
7-Apr-03	65.0
8-Apr-03	62.0
9-Apr-03	60.0
10-Apr-03	59.4
11-Apr-03	65.3
12-Apr-03	73.0
13-Apr-03	
14-Apr-03	96.3
15-Apr-03	98.0
16-Apr-03	98.3
17-Apr-03	95.5
18-Apr-03	93.7
19-Apr-03	
20-Apr-03	
21-Apr-03	95.7
22-Apr-03	93.7
23-Apr-03	92.9
24-Apr-03	89.3
25-Apr-03	89.6
26-Apr-03	
27-Apr-03	
28-Apr-03	94.3
29-Apr-03	92.6
30-Apr-03	89.1
1-May-03	90.6
2-May-03	88.8
3-May-03	85.9
4-May-03	
5-May-03	87.9
6-May-03	87.9
7-May-03	89.4
8-May-03	96.8
9-May-03	93.7
10-May-03	91.5
11-May-03	
12-May-03	90.9
13-May-03	87.5
14-May-03	84.0
15-May-03	77.8
16-May-03	79.2
17-May-03	78.6
18-May-03	75.8

F.R.S.W.C.

Leachate Data

2003

CELL	1&2
Date	Cell Level Inches
19-May-03	
20-May-03	74.3
21-May-03	71.7
22-May-03	69.3
23-May-03	69.7
24-May-03	65.8
25-May-03	62.0
26-May-03	63.2
27-May-03	50.4
28-May-03	47.9
29-May-03	53.6
30-May-03	54.3
31-May-03	43.5
1-Jun-03	39.9
2-Jun-03	67.0
3-Jun-03	59.7
4-Jun-03	57.7
5-Jun-03	41.4
6-Jun-03	43.4
7-Jun-03	40.0
8-Jun-03	33.1
9-Jun-03	30.0
10-Jun-03	
11-Jun-03	42.6
12-Jun-03	43.9
13-Jun-03	32.7
14-Jun-03	45.9
15-Jun-03	
16-Jun-03	
17-Jun-03	68.3
18-Jun-03	66.0
19-Jun-03	61.1
20-Jun-03	57.8
21-Jun-03	
22-Jun-03	
23-Jun-03	46.0
24-Jun-03	53.8
25-Jun-03	48.0
26-Jun-03	49.1
27-Jun-03	45.0
28-Jun-03	44.6
29-Jun-03	
30-Jun-03	52.6
1-Jul-03	
2-Jul-03	61.4
3-Jul-03	43.5

Top of Sump 31.5 inches

Date	Cell Level Inches
4-Jul-03	43.1
5-Jul-03	30.0
6-Jul-03	
7-Jul-03	
8-Jul-03	57.2
9-Jul-03	44.5
10-Jul-03	43.1
11-Jul-03	29.8
12-Jul-03	43.0
13-Jul-03	
14-Jul-03	52.5
15-Jul-03	50.5
16-Jul-03	43.3
17-Jul-03	41.0
18-Jul-03	40.3
19-Jul-03	24.6
20-Jul-03	
21-Jul-03	53.6
22-Jul-03	40.4
23-Jul-03	59.0
24-Jul-03	68.9
25-Jul-03	71.3
26-Jul-03	71.7
27-Jul-03	
28-Jul-03	68.5
29-Jul-03	71.9
30-Jul-03	68.7
31-Jul-03	64.0
1-Aug-03	
2-Aug-03	
3-Aug-03	
4-Aug-03	83.6
5-Aug-03	96.2
6-Aug-03	96.0
7-Aug-03	88.7
8-Aug-03	92.1
9-Aug-03	90.4
10-Aug-03	
11-Aug-03	90.6
12-Aug-03	85.0
13-Aug-03	82.4
14-Aug-03	77.7
15-Aug-03	70.2
16-Aug-03	
17-Aug-03	
18-Aug-03	70.2

Top of Liner 126.0 inches

Date	Cell Level Inches
19-Aug-03	63.0
20-Aug-03	63.8
21-Aug-03	56.2
22-Aug-03	60.0
23-Aug-03	
24-Aug-03	
25-Aug-03	55.9
26-Aug-03	54.6
27-Aug-03	40.0
28-Aug-03	41.0
29-Aug-03	46.3
30-Aug-03	
31-Aug-03	
1-Sep-03	
2-Sep-03	57.5
3-Sep-03	48.6
4-Sep-03	48.2
5-Sep-03	64.9
6-Sep-03	66.3
7-Sep-03	69.0
8-Sep-03	
9-Sep-03	67.1
10-Sep-03	66.2
11-Sep-03	64.4
12-Sep-03	62.1
13-Sep-03	60.3
14-Sep-03	
15-Sep-03	62.3
16-Sep-03	61.7
17-Sep-03	58.7
18-Sep-03	33.3
19-Sep-03	45.8
20-Sep-03	
21-Sep-03	
22-Sep-03	57.2
23-Sep-03	54.3
24-Sep-03	56.9
25-Sep-03	59.9
26-Sep-03	62.9
27-Sep-03	
28-Sep-03	71.0
29-Sep-03	61.0
30-Sep-03	65.9
1-Oct-03	67.3
2-Oct-03	65.9
3-Oct-03	71.1

F.R.S.W.C. Leachate Data **2003**

CELL 1&2	
Date	Cell Level Inches
4-Oct-03	
5-Oct-03	
6-Oct-03	78.5
7-Oct-03	79.8
8-Oct-03	80.6
9-Oct-03	79.5
10-Oct-03	77.7
11-Oct-03	
12-Oct-03	
13-Oct-03	81.2
14-Oct-03	81.4
15-Oct-03	80.3
16-Oct-03	86.4
17-Oct-03	85.5
18-Oct-03	84.7
19-Oct-03	
20-Oct-03	87.2
21-Oct-03	82.4
22-Oct-03	91.9
23-Oct-03	89.3
24-Oct-03	89.9
25-Oct-03	
26-Oct-03	
27-Oct-03	92.8
28-Oct-03	91.1
29-Oct-03	87.2
30-Oct-03	106.5
31-Oct-03	102.5
1-Nov-03	104.7
2-Nov-03	
3-Nov-03	95.8
4-Nov-03	85.9
5-Nov-03	83.4
6-Nov-03	78.2
7-Nov-03	71.4
8-Nov-03	
9-Nov-03	
10-Nov-03	71.9
11-Nov-03	70.2
12-Nov-03	68.1
13-Nov-03	66.0
14-Nov-03	67.3
15-Nov-03	
16-Nov-03	
17-Nov-03	64.7
18-Nov-03	60.9

Date	
19-Nov-03	62.1
20-Nov-03	61.1
21-Nov-03	62.8
22-Nov-03	
23-Nov-03	
24-Nov-03	73.2
25-Nov-03	72.9
26-Nov-03	73.4
27-Nov-03	72.6
28-Nov-03	70.9
29-Nov-03	79.4
30-Nov-03	
1-Dec-03	101.4
2-Dec-03	100.8
3-Dec-03	95.9
4-Dec-03	93.7
5-Dec-03	92.0
6-Dec-03	
7-Dec-03	
8-Dec-03	96.1
9-Dec-03	95.6
10-Dec-03	95.0
11-Dec-03	92.5
12-Dec-03	100.0
13-Dec-03	108.4
14-Dec-03	
15-Dec-03	104.1
16-Dec-03	99.8
17-Dec-03	94.9
18-Dec-03	89.6
19-Dec-03	103.5
20-Dec-03	98.2
21-Dec-03	80.4
22-Dec-03	67.6
23-Dec-03	41.1
24-Dec-03	30.0
25-Dec-03	
26-Dec-03	
27-Dec-03	
28-Dec-03	
29-Dec-03	105.8
30-Dec-03	101.3
31-Dec-03	90.0

Date	Cell Level Inches

Top of Sump 31.5 inches **Top of Liner 126.0 inches**

F.R.S.W.C.

Leachate Data

2003

CELL 3	
Date	Cell Level Inches
1-Jan-03	
2-Jan-03	
3-Jan-03	
4-Jan-03	
5-Jan-03	
6-Jan-03	
7-Jan-03	
8-Jan-03	
9-Jan-03	
10-Jan-03	
11-Jan-03	
12-Jan-03	
13-Jan-03	
14-Jan-03	72.3
15-Jan-03	72.0
16-Jan-03	70.5
17-Jan-03	68.5
18-Jan-03	67.8
19-Jan-03	
20-Jan-03	66.8
21-Jan-03	66.8
22-Jan-03	66.4
23-Jan-03	65.3
24-Jan-03	63.7
25-Jan-03	
26-Jan-03	
27-Jan-03	61.9
28-Jan-03	64.5
29-Jan-03	64.1
30-Jan-03	65.8
31-Jan-03	65.9
1-Feb-03	
2-Feb-03	
3-Feb-03	71.3
4-Feb-03	73.7
5-Feb-03	78.4
6-Feb-03	80.0
7-Feb-03	80.4
8-Feb-03	
9-Feb-03	
10-Feb-03	93.7
11-Feb-03	82.5
12-Feb-03	80.6
13-Feb-03	79.1
14-Feb-03	78.0
15-Feb-03	

Top of Sump 31.5 inches

Date	Cell Level Inches
16-Feb-03	
17-Feb-03	77.6
18-Feb-03	75.8
19-Feb-03	73.0
20-Feb-03	68.0
21-Feb-03	66.2
22-Feb-03	63.4
23-Feb-03	61.1
24-Feb-03	65.1
25-Feb-03	62.2
26-Feb-03	58.6
27-Feb-03	48.5
28-Feb-03	30.7
1-Mar-03	
2-Mar-03	
3-Mar-03	49.0
4-Mar-03	58.3
5-Mar-03	58.1
6-Mar-03	56.2
7-Mar-03	55.2
8-Mar-03	
9-Mar-03	
10-Mar-03	58.1
11-Mar-03	60.0
12-Mar-03	57.5
13-Mar-03	50.5
14-Mar-03	42.8
15-Mar-03	
16-Mar-03	
17-Mar-03	33.9
18-Mar-03	31.5
19-Mar-03	37.8
20-Mar-03	40.2
21-Mar-03	43.2
22-Mar-03	
23-Mar-03	
24-Mar-03	85.6
25-Mar-03	88.3
26-Mar-03	89.3
27-Mar-03	92.9
28-Mar-03	99.3
29-Mar-03	103.8
30-Mar-03	102.2
31-Mar-03	114.2
1-Apr-03	103.8
2-Apr-03	79.5

Top of Liner 126.0 inches

Date	Cell Level Inches
3-Apr-03	71.5
4-Apr-03	69.1
5-Apr-03	70.9
6-Apr-03	
7-Apr-03	71.9
8-Apr-03	70.2
9-Apr-03	69.5
10-Apr-03	68.7
11-Apr-03	71.1
12-Apr-03	75.0
13-Apr-03	
14-Apr-03	93.5
15-Apr-03	94.0
16-Apr-03	94.3
17-Apr-03	93.4
18-Apr-03	91.9
19-Apr-03	
20-Apr-03	
21-Apr-03	92.0
22-Apr-03	90.4
23-Apr-03	90.0
24-Apr-03	88.7
25-Apr-03	88.9
26-Apr-03	
27-Apr-03	
28-Apr-03	93.7
29-Apr-03	93.1
30-Apr-03	91.0
1-May-03	92.5
2-May-03	94.7
3-May-03	95.5
4-May-03	
5-May-03	97.1
6-May-03	94.2
7-May-03	90.4
8-May-03	98.5
9-May-03	97.0
10-May-03	92.6
11-May-03	
12-May-03	94.7
13-May-03	92.7
14-May-03	89.4
15-May-03	88.1
16-May-03	87.9
17-May-03	87.3
18-May-03	86.2

F.R.S.W.C.

Leachate Data

2003

CELL	3
Date	Cell Level Inches
19-May-03	
20-May-03	86.9
21-May-03	84.1
22-May-03	81.3
23-May-03	81.9
24-May-03	79.9
25-May-03	79.3
26-May-03	82.0
27-May-03	78.0
28-May-03	70.0
29-May-03	62.0
30-May-03	61.7
31-May-03	59.6
1-Jun-03	52.2
2-Jun-03	56.3
3-Jun-03	54.0
4-Jun-03	56.1
5-Jun-03	47.0
6-Jun-03	32.8
7-Jun-03	34.0
8-Jun-03	33.8
9-Jun-03	15.0
10-Jun-03	
11-Jun-03	9.8
12-Jun-03	26.4
13-Jun-03	22.2
14-Jun-03	21.3
15-Jun-03	
16-Jun-03	57.0
17-Jun-03	57.8
18-Jun-03	56.5
19-Jun-03	53.0
20-Jun-03	52.4
21-Jun-03	
22-Jun-03	
23-Jun-03	12.7
24-Jun-03	24.7
25-Jun-03	21.9
26-Jun-03	21.4
27-Jun-03	22.6
28-Jun-03	20.1
29-Jun-03	
30-Jun-03	30.2
1-Jul-03	
2-Jul-03	51.4
3-Jul-03	19.3

Bottom of sump 0 inches

Date	
4-Jul-03	20.3
5-Jul-03	12.5
6-Jul-03	
7-Jul-03	
8-Jul-03	34.4
9-Jul-03	27.0
10-Jul-03	19.2
11-Jul-03	13.3
12-Jul-03	22.8
13-Jul-03	
14-Jul-03	31.8
15-Jul-03	28.9
16-Jul-03	18.7
17-Jul-03	19.7
18-Jul-03	19.3
19-Jul-03	11.7
20-Jul-03	
21-Jul-03	31.6
22-Jul-03	17.0
23-Jul-03	44.7
24-Jul-03	61.5
25-Jul-03	63.8
26-Jul-03	64.4
27-Jul-03	
28-Jul-03	64.0
29-Jul-03	64.7
30-Jul-03	61.6
31-Jul-03	59.2
1-Aug-03	56.1
2-Aug-03	
3-Aug-03	
4-Aug-03	71.4
5-Aug-03	80.4
6-Aug-03	85.5
7-Aug-03	86.1
8-Aug-03	87.5
9-Aug-03	85.5
10-Aug-03	
11-Aug-03	85.3
12-Aug-03	82.4
13-Aug-03	77.4
14-Aug-03	73.3
15-Aug-03	67.6
16-Aug-03	
17-Aug-03	
18-Aug-03	66.8

Top of liner 126.0 inches

Date	Cell Level Inches
19-Aug-03	60.8
20-Aug-03	60.6
21-Aug-03	55.7
22-Aug-03	55.4
23-Aug-03	
24-Aug-03	
25-Aug-03	54.7
26-Aug-03	50.6
27-Aug-03	16.0
28-Aug-03	14.5
29-Aug-03	22.9
30-Aug-03	
31-Aug-03	
1-Sep-03	
2-Sep-03	36.9
3-Sep-03	26.2
4-Sep-03	24.4
5-Sep-03	48.2
6-Sep-03	47.6
7-Sep-03	
8-Sep-03	47.7
9-Sep-03	47.8
10-Sep-03	45.1
11-Sep-03	42.8
12-Sep-03	37.8
13-Sep-03	32.9
14-Sep-03	
15-Sep-03	35.1
16-Sep-03	33.8
17-Sep-03	28.7
18-Sep-03	25.7
19-Sep-03	30.1
20-Sep-03	
21-Sep-03	
22-Sep-03	40.0
23-Sep-03	33.5
24-Sep-03	36.2
25-Sep-03	40.9
26-Sep-03	43.7
27-Sep-03	
28-Sep-03	54.0
29-Sep-03	39.5
30-Sep-03	45.9
1-Oct-03	48.3
2-Oct-03	45.9
3-Oct-03	51.5

F.R.S.W.C. Leachate Data 2003

CELL 3

Date	Cell Level Inches
4-Oct-03	
5-Oct-03	
6-Oct-03	57.8
7-Oct-03	58.2
8-Oct-03	58.6
9-Oct-03	56.6
10-Oct-03	54.9
11-Oct-03	
12-Oct-03	
13-Oct-03	55.7
14-Oct-03	59.5
15-Oct-03	56.4
16-Oct-03	62.5
17-Oct-03	61.8
18-Oct-03	57.4
19-Oct-03	
20-Oct-03	59.9
21-Oct-03	53.5
22-Oct-03	65.0
23-Oct-03	62.0
24-Oct-03	62.6
25-Oct-03	
26-Oct-03	
27-Oct-03	79.3
28-Oct-03	72.0
29-Oct-03	76.0
30-Oct-03	106.6
31-Oct-03	110.2
1-Nov-03	91.7
2-Nov-03	
3-Nov-03	104.5
4-Nov-03	103.3
5-Nov-03	95.0
6-Nov-03	90.7
7-Nov-03	85.3
8-Nov-03	
9-Nov-03	
10-Nov-03	84.3
11-Nov-03	834
12-Nov-03	79.8
13-Nov-03	79.0
14-Nov-03	79.8
15-Nov-03	
16-Nov-03	
17-Nov-03	73.5
18-Nov-03	72.6

Date	
19-Nov-03	71.5
20-Nov-03	70.0
21-Nov-03	71.1
22-Nov-03	
23-Nov-03	
24-Nov-03	74.5
25-Nov-03	74.5
26-Nov-03	75.0
27-Nov-03	72.8
28-Nov-03	70.0
29-Nov-03	80.0
30-Nov-03	
1-Dec-03	86.8
2-Dec-03	86.6
3-Dec-03	82.8
4-Dec-03	80.4
5-Dec-03	78.2
6-Dec-03	
7-Dec-03	
8-Dec-03	80.0
9-Dec-03	79.5
10-Dec-03	79.0
11-Dec-03	77.5
12-Dec-03	83.2
13-Dec-03	85.7
14-Dec-03	
15-Dec-03	80.8
16-Dec-03	78.0
17-Dec-03	77.1
18-Dec-03	75.3
19-Dec-03	89.7
20-Dec-03	92.4
21-Dec-03	93.1
22-Dec-03	85.7
23-Dec-03	78.6
24-Dec-03	62.0
25-Dec-03	
26-Dec-03	
27-Dec-03	
28-Dec-03	
29-Dec-03	86.0
30-Dec-03	89.7
31-Dec-03	84.4

Date	Cell Level Inches

Bottom of sump 0 inches

Top of liner 126.0 inches

F.R.S.W.C. Leachate Data 2004

CELL	1&2
Date	Cell Level Inches
1-Jan-04	
2-Jan-04	87.8
3-Jan-04	82
4-Jan-04	77.9
5-Jan-04	75.6
6-Jan-04	77.3
7-Jan-04	78
8-Jan-04	74.9
9-Jan-04	72.3
10-Jan-04	
11-Jan-04	
12-Jan-04	75.3
13-Jan-04	72.8
14-Jan-04	73.2
15-Jan-04	75.7
16-Jan-04	72.2
17-Jan-04	
18-Jan-04	
19-Jan-04	76
20-Jan-04	77
21-Jan-04	71.6
22-Jan-04	72.6
23-Jan-04	65.6
24-Jan-04	
25-Jan-04	
26-Jan-04	
27-Jan-04	67.7
28-Jan-04	68.8
29-Jan-04	67.6
30-Jan-04	65.2
31-Jan-04	
1-Feb-04	
2-Feb-04	66.8
3-Feb-04	58.7
4-Feb-04	56.7
5-Feb-04	63.5
6-Feb-04	60.0
7-Feb-04	47.8
8-Feb-04	
9-Feb-04	59
10-Feb-04	51.4
11-Feb-04	47
12-Feb-04	46.0
13-Feb-04	46.2
14-Feb-04	
15-Feb-04	

Top of Sump 31.5 inches

Date	Cell Level Inches
16-Feb-04	58.7
17-Feb-04	47.5
18-Feb-04	55.6
19-Feb-04	57.6
20-Feb-04	52.4
21-Feb-04	
22-Feb-04	
23-Feb-04	56
24-Feb-04	55.4
25-Feb-04	49.6
26-Feb-04	50.2
27-Feb-04	47.3
28-Feb-04	
1-Mar-04	54.7
2-Mar-04	48.7
3-Mar-04	39.8
4-Mar-04	70.2
5-Mar-04	70.0
6-Mar-04	
7-Mar-04	
8-Mar-04	81
9-Mar-04	77
10-Mar-04	75.2
11-Mar-04	76.7
12-Mar-04	
13-Mar-04	
14-Mar-04	
15-Mar-04	73.2
16-Mar-04	72.3
17-Mar-04	74.2
18-Mar-04	73.5
19-Mar-04	74.8
20-Mar-04	
21-Mar-04	
22-Mar-04	78.7
23-Mar-04	79.7
24-Mar-04	79.7
25-Mar-04	75.3
26-Mar-04	76.7
27-Mar-04	
28-Mar-04	
29-Mar-04	89
30-Mar-04	99.9
31-Mar-04	95.2
1-Apr-04	88.6

Top of Liner 126.0 inches

Date	Cell Level Inches
2-Apr-04	87.6
3-Apr-04	86.1
4-Apr-04	84.4
5-Apr-04	84.6
6-Apr-04	76.6
7-Apr-04	65.5
8-Apr-04	65.7
9-Apr-04	63.9
10-Apr-04	
11-Apr-04	
12-Apr-04	72.4
13-Apr-04	72.1
14-Apr-04	71.5
15-Apr-04	83.6
16-Apr-04	94.8
17-Apr-04	96.4
18-Apr-04	96.8
19-Apr-04	97.9
20-Apr-04	95.1
21-Apr-04	85.5
22-Apr-04	82.6
23-Apr-04	76.9
24-Apr-04	
25-Apr-04	
26-Apr-04	72.7
27-Apr-04	66.2
28-Apr-04	63.1
29-Apr-04	54.8
30-Apr-04	36
1-May-04	
2-May-04	
3-May-04	57.7
4-May-04	57.3
5-May-04	75.7
6-May-04	77.1
7-May-04	78.6
8-May-04	
9-May-04	
10-May-04	77.5
11-May-04	78
12-May-04	70.8
13-May-04	68.2
14-May-04	64.7
15-May-04	
16-May-04	
17-May-04	65.4

F.R.S.W.C. Leachate Data 2004

CELL	1&2
Date	Cell Level Inches
18-May-04	62.8
19-May-04	55.9
20-May-04	59.5
21-May-04	51.4
22-May-04	
23-May-04	
24-May-04	
25-May-04	62.5
26-May-04	47.6
27-May-04	39.8
28-May-04	50.5
29-May-04	
30-May-04	
31-May-04	58.8
1-Jun-04	55.2
2-Jun-04	52
3-Jun-04	52.2
4-Jun-04	62.1
5-Jun-04	
6-Jun-04	
7-Jun-04	59.1
8-Jun-04	62.0
9-Jun-04	60.8
10-Jun-04	58.1
11-Jun-04	51.1
12-Jun-04	48.1
13-Jun-04	
14-Jun-04	55.2
15-Jun-04	54.8
16-Jun-04	47
17-Jun-04	43.9
18-Jun-04	44.8
19-Jun-04	
20-Jun-04	
21-Jun-04	57
22-Jun-04	58.8
23-Jun-04	61.1
24-Jun-04	61.0
25-Jun-04	57.2
26-Jun-04	57.6
27-Jun-04	
28-Jun-04	68.2
29-Jun-04	67.3
30-Jun-04	64.5
1-Jul-04	
2-Jul-04	65.9

Top of Sump 31.5 inches

Date	Cell Level Inches
3-Jul-04	
4-Jul-04	
5-Jul-04	71.4
6-Jul-04	72.2
7-Jul-04	72.1
8-Jul-04	69.5
9-Jul-04	68.2
10-Jul-04	69.2
11-Jul-04	
12-Jul-04	72.8
13-Jul-04	68.9
14-Jul-04	71
15-Jul-04	69.7
16-Jul-04	64.5
17-Jul-04	
18-Jul-04	
19-Jul-04	62.7
20-Jul-04	63.4
21-Jul-04	57.2
22-Jul-04	53.7
23-Jul-04	35.7
24-Jul-04	
25-Jul-04	
26-Jul-04	52.5
27-Jul-04	43.2
28-Jul-04	42.8
29-Jul-04	46.6
30-Jul-04	48.1
31-Jul-04	
1-Aug-04	
2-Aug-04	
3-Aug-04	56.2
4-Aug-04	59.9
5-Aug-04	62.7
6-Aug-04	62.6
7-Aug-04	
8-Aug-04	
9-Aug-04	57.4
10-Aug-04	54.5
11-Aug-04	43.3
12-Aug-04	43.1
13-Aug-04	40.7
14-Aug-04	60.2
15-Aug-04	71.0
16-Aug-04	72.6
17-Aug-04	73.3

Top of Liner 126.0 inches

Date	Cell Level Inches
18-Aug-04	62.7
19-Aug-04	46
20-Aug-04	32.2
21-Aug-04	43.4
22-Aug-04	
23-Aug-04	71.1
24-Aug-04	70.2
25-Aug-04	69.2
26-Aug-04	70.6
27-Aug-04	71.2
28-Aug-04	
29-Aug-04	
30-Aug-04	72.8
31-Aug-04	73.8
1-Sep-04	80.5
2-Sep-04	81.8
3-Sep-04	76.8
4-Sep-04	
5-Sep-04	
6-Sep-04	77.8
7-Sep-04	76
8-Sep-04	71.9
9-Sep-04	67.6
10-Sep-04	72.3
11-Sep-04	74
12-Sep-04	
13-Sep-04	74.4
14-Sep-04	72.7
15-Sep-04	68.9
16-Sep-04	61.2
17-Sep-04	54.9
18-Sep-04	
19-Sep-04	
20-Sep-04	69.8
21-Sep-04	65.3
22-Sep-04	61.4
23-Sep-04	58.2
24-Sep-04	53.6
25-Sep-04	
26-Sep-04	
27-Sep-04	61.9
28-Sep-04	64.3
29-Sep-04	55.5
30-Sep-04	48.5
1-Oct-04	48.5
2-Oct-04	

F.R.S.W.C. Leachate Data **2004**

CELL	1&2
Date	Cell Level Inches
3-Oct-04	
4-Oct-04	55.8
5-Oct-04	57.6
6-Oct-04	35.3
7-Oct-04	35.7
8-Oct-04	41.1
9-Oct-04	
10-Oct-04	
11-Oct-04	57.2
12-Oct-04	61
13-Oct-04	63.9
14-Oct-04	46.3
15-Oct-04	58.7
16-Oct-04	
17-Oct-04	
18-Oct-04	63.6
19-Oct-04	44.2
20-Oct-04	36.9
21-Oct-04	33
22-Oct-04	35.9
23-Oct-04	
24-Oct-04	
25-Oct-04	57
26-Oct-04	47.3
27-Oct-04	37.5
28-Oct-04	47.7
29-Oct-04	36.0
30-Oct-04	
31-Oct-04	
1-Nov-04	45.7
2-Nov-04	29.7
3-Nov-04	42.4
4-Nov-04	41
5-Nov-04	32.1
6-Nov-04	
7-Nov-04	
8-Nov-04	66.2
9-Nov-04	68.9
10-Nov-04	72.4
11-Nov-04	71.8
12-Nov-04	72.9
13-Nov-04	
14-Nov-04	
15-Nov-04	77.0
16-Nov-04	78.1
17-Nov-04	77.9

Top of Sump 31.5 inches

Date	
18-Nov-04	75.6
19-Nov-04	74.1
20-Nov-04	
21-Nov-04	
22-Nov-04	78.4
23-Nov-04	74.3
24-Nov-04	69.3
25-Nov-04	73.5
26-Nov-04	84.2
27-Nov-04	82.9
28-Nov-04	
29-Nov-04	77.1
30-Nov-04	75.3
1-Dec-04	73.8
2-Dec-04	79.4
3-Dec-04	77.7
4-Dec-04	74.3
5-Dec-04	69.1
6-Dec-04	66.2
7-Dec-04	64
8-Dec-04	62.9
9-Dec-04	54.2
10-Dec-04	57.3
11-Dec-04	52.1
12-Dec-04	
13-Dec-04	75.3
14-Dec-04	74.9
15-Dec-04	72.8
16-Dec-04	71.1
17-Dec-04	61.3
18-Dec-04	36.3
19-Dec-04	
20-Dec-04	38.9
21-Dec-04	35.2
22-Dec-04	
23-Dec-04	27.1
24-Dec-04	68.1
25-Dec-04	
26-Dec-04	82.5
27-Dec-04	81.9
28-Dec-04	83.7
29-Dec-04	78.9
30-Dec-04	74.0
31-Dec-04	67.7

Top of Liner 126.0 inches

Date	Cell Level Inches

F.R.S.W.C.

Leachate Data

2004

CELL	3
Date	Cell Level Inches
1-Jan-04	
2-Jan-04	80.5
3-Jan-04	78.5
4-Jan-04	71.9
5-Jan-04	70.2
6-Jan-04	68.1
7-Jan-04	55.5
8-Jan-04	55.9
9-Jan-04	50.6
10-Jan-04	
11-Jan-04	
12-Jan-04	52
13-Jan-04	46.5
14-Jan-04	48.0
15-Jan-04	51.0
16-Jan-04	54
17-Jan-04	
18-Jan-04	
19-Jan-04	53.8
20-Jan-04	57.2
21-Jan-04	58.0
22-Jan-04	62.3
23-Jan-04	61.6
24-Jan-04	
25-Jan-04	
26-Jan-04	68.5
27-Jan-04	68.0
28-Jan-04	64.3
29-Jan-04	65.0
30-Jan-04	73
31-Jan-04	
1-Feb-04	
2-Feb-04	65.8
3-Feb-04	60.0
4-Feb-04	59
5-Feb-04	645.0
6-Feb-04	61.9
7-Feb-04	54.6
8-Feb-04	
9-Feb-04	61
10-Feb-04	59.0
11-Feb-04	44.2
12-Feb-04	34.5
13-Feb-04	30.9
14-Feb-04	
15-Feb-04	

Top of Sump 31.5 inches

Date	Cell Level Inches
16-Feb-04	43.2
17-Feb-04	32.5
18-Feb-04	32.7
19-Feb-04	40.4
20-Feb-04	33.8
21-Feb-04	
22-Feb-04	
23-Feb-04	42.9
24-Feb-04	42.9
25-Feb-04	33
26-Feb-04	35.7
27-Feb-04	33.9
28-Feb-04	
29-Feb-04	
1-Mar-04	40
2-Mar-04	39.8
3-Mar-04	49.6
4-Mar-04	58.1
5-Mar-04	60.6
6-Mar-04	
7-Mar-04	
8-Mar-04	72.3
9-Mar-04	69.2
10-Mar-04	64.9
11-Mar-04	
12-Mar-04	67.8
13-Mar-04	
14-Mar-04	
15-Mar-04	64.5
16-Mar-04	65.4
17-Mar-04	66.8
18-Mar-04	61.7
19-Mar-04	63.1
20-Mar-04	
21-Mar-04	
22-Mar-04	65.8
23-Mar-04	69.8
24-Mar-04	66.5
25-Mar-04	64.6
26-Mar-04	64.9
27-Mar-04	
28-Mar-04	
29-Mar-04	76.9
30-Mar-04	89.9
31-Mar-04	81.8
1-Apr-04	87.5

Top of Liner 126.0 inches

Date	Cell Level Inches
2-Apr-04	84.5
3-Apr-04	83.9
4-Apr-04	71.3
5-Apr-04	76.7
6-Apr-04	68.9
7-Apr-04	67
8-Apr-04	65.9
9-Apr-04	62.2
10-Apr-04	
11-Apr-04	
12-Apr-04	67.6
13-Apr-04	65.9
14-Apr-04	62.9
15-Apr-04	74
16-Apr-04	80.5
17-Apr-04	82
18-Apr-04	82.9
19-Apr-04	83.3
20-Apr-04	80.8
21-Apr-04	74.7
22-Apr-04	68.7
23-Apr-04	60.7
24-Apr-04	
25-Apr-04	
26-Apr-04	55.9
27-Apr-04	48.5
28-Apr-04	46.7
29-Apr-04	38.5
30-Apr-04	42.3
1-May-04	
2-May-04	
3-May-04	46.2
4-May-04	47.3
5-May-04	65.8
6-May-04	67
7-May-04	68.1
8-May-04	
9-May-04	
10-May-04	67.2
11-May-04	68.3
12-May-04	66.6
13-May-04	59.2
14-May-04	56.9
15-May-04	53.7
16-May-04	
17-May-04	59.3

F.R.S.W.C. Leachate Data 2004

CELL 3.

Date	Cell Level Inches
18-May-04	56.9
19-May-04	51.8
20-May-04	50.7
21-May-04	39.5
22-May-04	
23-May-04	
24-May-04	
25-May-04	53.8
26-May-04	36.3
27-May-04	38.4
28-May-04	40.7
29-May-04	
30-May-04	
31-May-04	48
1-Jun-04	45.2
2-Jun-04	42
3-Jun-04	42.1
4-Jun-04	53.5
5-Jun-04	
6-Jun-04	
7-Jun-04	50.6
8-Jun-04	55.9
9-Jun-04	57.0
10-Jun-04	55.7
11-Jun-04	50
12-Jun-04	37.9
13-Jun-04	
14-Jun-04	42.8
15-Jun-04	43.3
16-Jun-04	37.2
17-Jun-04	37.9
18-Jun-04	48.0
19-Jun-04	
20-Jun-04	
21-Jun-04	55.1
22-Jun-04	55.9
23-Jun-04	48.2
24-Jun-04	54.0
25-Jun-04	51.1
26-Jun-04	51.2
27-Jun-04	
28-Jun-04	63.8
29-Jun-04	63.2
30-Jun-04	60.7
1-Jul-04	
2-Jul-04	61.3

Bottom of sump 0 inches

Date	
3-Jul-04	
4-Jul-04	
5-Jul-04	64
6-Jul-04	65.2
7-Jul-04	65.2
8-Jul-04	62.8
9-Jul-04	61.8
10-Jul-04	61.9
11-Jul-04	
12-Jul-04	65.1
13-Jul-04	63.2
14-Jul-04	67.5
15-Jul-04	66.6
16-Jul-04	61.7
17-Jul-04	
18-Jul-04	
19-Jul-04	59.4
20-Jul-04	60.5
21-Jul-04	54.8
22-Jul-04	52.1
23-Jul-04	33.8
24-Jul-04	
25-Jul-04	
26-Jul-04	45.9
27-Jul-04	47.9
28-Jul-04	49.3
29-Jul-04	35.2
30-Jul-04	40.0
31-Jul-04	
1-Aug-04	
2-Aug-04	
3-Aug-04	45.4
4-Aug-04	49.7
5-Aug-04	51.6
6-Aug-04	48.3
7-Aug-04	
8-Aug-04	
9-Aug-04	52
10-Aug-04	53.2
11-Aug-04	53.1
12-Aug-04	54.2
13-Aug-04	55.5
14-Aug-04	64.5
15-Aug-04	74.7
16-Aug-04	75.9
17-Aug-04	76.3

Top of liner 126.0 inches

Date	Cell Level Inches
18-Aug-04	69.3
19-Aug-04	59.3
20-Aug-04	34.7
21-Aug-04	55.0
22-Aug-04	
23-Aug-04	67.9
24-Aug-04	67.2
25-Aug-04	68
26-Aug-04	68.8
27-Aug-04	69.5
28-Aug-04	
29-Aug-04	
30-Aug-04	72.0
31-Aug-04	73.1
1-Sep-04	83.9
2-Sep-04	85.4
3-Sep-04	81.8
4-Sep-04	
5-Sep-04	
6-Sep-04	82.4
7-Sep-04	81
8-Sep-04	78.8
9-Sep-04	76.6
10-Sep-04	79.6
11-Sep-04	83.9
12-Sep-04	
13-Sep-04	84.0
14-Sep-04	82.2
15-Sep-04	80.3
16-Sep-04	76.1
17-Sep-04	78.4
18-Sep-04	
19-Sep-04	
20-Sep-04	86
21-Sep-04	83.6
22-Sep-04	81.4
23-Sep-04	80
24-Sep-04	78.7
25-Sep-04	
26-Sep-04	
27-Sep-04	79.9
28-Sep-04	81.7
29-Sep-04	77.3
30-Sep-04	75.9
1-Oct-04	75.6
2-Oct-04	

F.R.S.W.C. Leachate Data **2004**

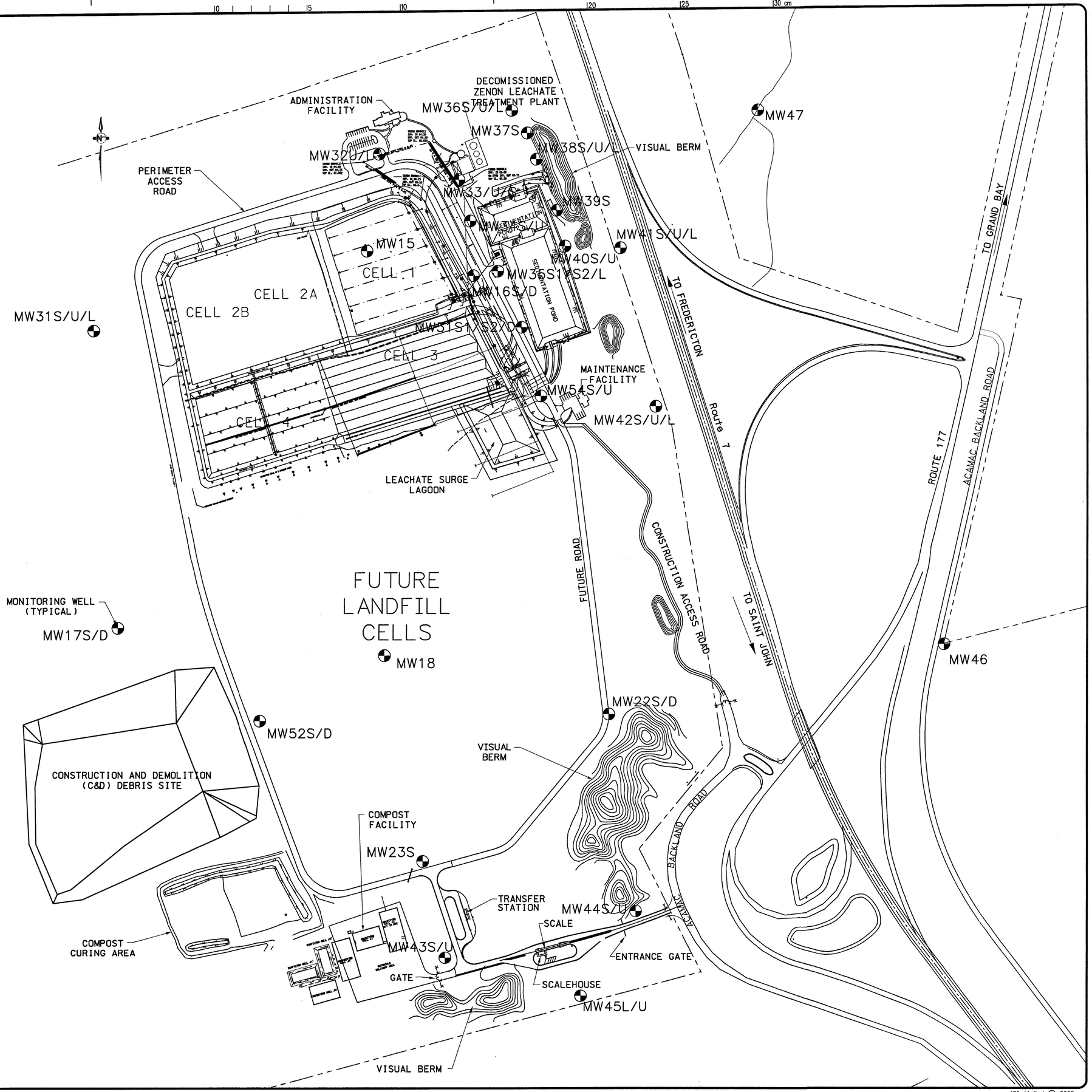
CELL	3
Date	Cell Level Inches
3-Oct-04	
4-Oct-04	75.8
5-Oct-04	75.5
6-Oct-04	71.9
7-Oct-04	67.3
8-Oct-04	62
9-Oct-04	
10-Oct-04	
11-Oct-04	71.2
12-Oct-04	71.5
13-Oct-04	73.8
14-Oct-04	69.7
15-Oct-04	68.7
16-Oct-04	
17-Oct-04	
18-Oct-04	73.5
19-Oct-04	66.6
20-Oct-04	62
21-Oct-04	56.2
22-Oct-04	27.5
23-Oct-04	
24-Oct-04	
25-Oct-04	44
26-Oct-04	27.6
27-Oct-04	30.3
28-Oct-04	36.9
29-Oct-04	29.5
30-Oct-04	
31-Oct-04	
1-Nov-04	35.7
2-Nov-04	29.9
3-Nov-04	38
4-Nov-04	31.8
5-Nov-04	39.9
6-Nov-04	
7-Nov-04	
8-Nov-04	62.6
9-Nov-04	72.2
10-Nov-04	77.3
11-Nov-04	78.3
12-Nov-04	78.1
13-Nov-04	
14-Nov-04	
15-Nov-04	80.2
16-Nov-04	80.7
17-Nov-04	80.6

Date	
18-Nov-04	78
19-Nov-04	78.3
20-Nov-04	
21-Nov-04	
22-Nov-04	82
23-Nov-04	80.2
24-Nov-04	77.4
25-Nov-04	81.9
26-Nov-04	95.2
27-Nov-04	93.2
28-Nov-04	
29-Nov-04	90.8
30-Nov-04	89.8
1-Dec-04	92.2
2-Dec-04	98.3
3-Dec-04	97
4-Dec-04	95.9
5-Dec-04	93
6-Dec-04	90.8
7-Dec-04	89.0
8-Dec-04	89
9-Dec-04	88.8
10-Dec-04	90.6
11-Dec-04	91.9
12-Dec-04	
13-Dec-04	100
14-Dec-04	100.2
15-Dec-04	99.8
16-Dec-04	97.1
17-Dec-04	94
18-Dec-04	90.1
19-Dec-04	
20-Dec-04	78.9
21-Dec-04	60.3
22-Dec-04	
23-Dec-04	28.4
24-Dec-04	72.3
25-Dec-04	
26-Dec-04	101.7
27-Dec-04	100.7
28-Dec-04	95.0
29-Dec-04	84.1
30-Dec-04	80.8
31-Dec-04	77.7

Date	Cell Level Inches

Bottom of sump 0 inches

Top of liner 126.0 inches



No.	Revision	Ckd. By	Date

PRELIMINARY

	Const. North
	Drawn By: OSE
	Dwg. Standards Ckd. By:
	Designed By: TKO
Date Printed	Dwg. Design Ckd. By:

ADI Limited
Saint John, NB, Canada
Engineering, Consulting, Procurement and Project Management

Project Title
INDEPENDENT EXTERNAL REVIEW OF CRANE MOUNTAIN LANDFILL

Dwg. Title
OVERALL LANDFILL PLAN

Project No.	Dwg. No.	Rev. No.	Scale
5668-001.1	FIGURE 2-3	0	1:2500 This drawing is not to be scaled

Offices located in:
Charlottetown, Moncton, Saint John, Truro, Halifax, Sydney
Port Hawkesbury, St.John's, Fredericton and Salem, NH

COMPUTER GENERATED MICROSTATION SYSTEM