

BURLINGTON LANDFILL SITE
LEACHATE MANAGEMENT CONTINGENCY PLAN

Cr. Mulkewich

Hydrogeological - Geotechnical Report
August 1980 for Contingency System
is part of this report.

W. J. Wozniak

8835-01

SEPTEMBER 1981

DILLON

Consulting Engineers & Planners



Consulting Engineers & Planners

OUR FILE:

8835-01

YOUR FILE:

28 September 1981

Regional Municipality of Halton
1151 Bronte Road
P.O. Box 7000
Oakville, Ontario
L6J 6E1

Attention: Mr. D.J. Corbett, P.Eng.
Manager of Construction

Burlington Landfill Site
- Leachate Contingency Plan

Dear Sirs:

We are pleased to submit our final report for a contingency plan for leachate control for the Burlington Landfill Site. This plan is premised on the protection of water quality in Falcon Creek as a result of ground water migration from the landfill. The plan would only be implemented if the monitoring program indicates that contaminants are migrating to the Creek resulting in unacceptable impairment of water quality.

Appended to this report is a hydrogeological-geotechnical aspects of this study prepared for Dillon by Gartner Lee Associates Limited.

Yours truly,

M. M. DILLON LIMITED

P.C. Murray, P.Eng.
Project Manager

PCM:mrh
Encl.

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BURLINGTON LANDFILL SITE
LEACHATE MANAGEMENT CONTINGENCY PLAN

1. INTRODUCTION

1.1 Background

Expansions to the Burlington Landfill Site are currently underway to provide landfill capacity in Halton until a new regional facility can be established. The site operates under Provisional Certificate of Approval A210102 dated 31 January 1980. The Phase I expansion provides for landfill capacity over an area previously landfilled in the north part of the existing site. A Certificate was issued 24 October 1980 to provide for continued landfilling in the Phase I expansion and to allow for development of the Phase II expanded area. Phase II provides landfill capacity on the property north of the existing site. The Certificate requires, via Condition No. 7 that "prior to landfilling in the Phase II expansion area, a contingency plan, for the east side of Falcon Creek valley to intercept leachate must be submitted by the Regional Municipality of Halton and approved by the Director of the Environmental Approvals Branch of the Ministry of the Environment".

1.2 Purpose and Scope

The Hydrogeological Study prepared for the Burlington Landfill Site expansion indicates that leachate produced within the expansion area infiltrates into the underlying shale and migrates towards the Falcon Creek Valley with a minor

component northwesterly. Ground water flow in the southern portion of the site is downward and towards the southeast with southwesterly components towards Falcon Creek Valley. The hydrogeological study concluded in part that there should be contingency plans for an interceptor drain on the east side of the Falcon Creek Valley in case monitoring results indicate unacceptable level of contaminants.

This report has been prepared to provide the basis for a contingency plan for the provision of leachate control works in addition to and as backup to existing leachate control facilities. These works would only be constructed if warranted by significant deterioration of or impact on water quality in Falcon Creek as a result of the landfill operation.

A monitoring program is in effect at the site to provide data on surface water and ground water. The purpose of the program is to assess the impact of the landfill on water quality, if any, by providing data on ground water quality down gradient of the site and by measuring surface water quality in Falcon Creek, upstream and downstream of the site.

This report presents concepts for a leachate control contingency system based on hydrogeological criteria developed by Gartner Lee Associates Limited. The report can be found in Appendix A.

2. HYDROGEOLOGY

The hydrogeology and design and operations of the site have been reported in the following documents:

- i) Burlington Landfill Site Hydrogeologic Report
prepared by Gartner Lee Associates,
October 1979.
- ii) Burlington Landfill Site. Design and Operations Report prepared by M.M. Dillon Limited,
October 1981.
- iii) Burlington Landfill Site, Monitoring Program Report, prepared by Gartner Lee Associates,
April 1980.
- iv) Burlington Landfill Site, Monitoring Program - Interim Report, prepared by Gartner Lee Associates, April 1981.

The site is situated on the lower slopes of the Niagara Escarpment and is composed of glacial till soils over Queenston Shale bedrock. The Falcon Creek valley, eroded into the shale bedrock, borders the north and west limits of the site and its proposed northerly expansion.

Ground water recharges within the proposed expansion area and the existing site. Ground water flow is southeasterly under the existing site with components to the east, west and northwest. The natural quality of the ground water in the shale is relatively poor and may not locally comply with Ministry of the Environment drinking water guidelines.

Leachate produced at the site by surface water infiltration migrates to the underlying shale. Travel is then principally downward and southeasterly with minor components of flow towards the southwest. The westerly component is toward Falcon Creek. The monitoring program observes the quality and rate of leakage, if any, to Falcon Creek. Monitoring stations BH14 and BH15 were installed as shown in Appendix A. These are intended specifically to intercept the flow component from the landfill to the Creek. Surface water quality in Falcon Creek will be monitored at three stations, SW1, SW2, and SW3. SW1 is located upstream of the proposed Phase II expansion, SW2 opposite the north limit of the Phase I expansion (i.e. the existing site) and SW3 downstream of the landfill at the North Service Road. Ground water monitoring station BH12 will provide data on the southeasterly flow component, that is, toward the North Service Road. Ground water stations 8A and 11A monitor leachate mounding within the site and leachate infiltration into the underlying shale.

3. LEACHATE CONTROL

3.1 Present System

A toe drain leachate collector system was installed in 1980 along the east, south and west sides of the existing landfill to control the surface discharge of leachate. The existing system is shown in plan view on Figures 1 to 3. This system is connected to a sanitary sewer on the North Service Road opposite the Tridon Plant west of the landfill. Collected leachate ultimately discharges to the Burlington Skyway Water Pollution Control Plant for treatment.

A metering station was installed to provide continuous records of leachate flows. Flows are telemetered to the Burlington Skyway Water Pollution Control Plant where they are recorded on a continuous flow recorder. In this way, the quantity of leachate collected from the landfill is measured and may be related to actual landfill activities.

3.2 Phase I Expansion

Subsurface investigations and examination of archival aerial photography dating back to 1942 indicate that the present landfill covers an area formerly incised by three deep gullies approximately 15 m in depth. The existing toe drain leachate collector system will be extended along the west limit of the Phase I expansion area. The toe drain collector will be installed in undisturbed soils, where possible, on the west bank of the gully adjacent to the Falcon Creek

Ravine. The collector will prevent the surface discharge of leachate from the toe of the Phase I expansion to the Falcon Creek Ravine.

The collector will be designed to also transmit flows collected from the Phase II expansion underdrain system.

3.3 Phase II Expansion

An underdrain leachate collector system will be installed in the Phase II expansion area to control the surface and sub-surface flow of leachate. This area will be excavated and prepared to uniformly graded base contour plan. Collectors will be installed in parallel runs 30 to 45 m apart and drain to the last manhole on the Phase I toe drain leachate collector system. The underdrain system will drain leachate from the base of the landfill and thus control the development of a leachate mound within the fill.

3.4 Future Adjacent Systems

The City of Burlington retained M.M. Dillon Limited to investigate the requirements for leachate control at the closed Bayview Landfill. Should leachate control works be required, collected leachate may be discharged to the Burlington landfill site transmission sewer.

A proposal has been submitted to the Region to develop landfill capacity on lands to the east of the present Burlington Landfill Site, the proponent is National Sewer Pipe Ltd. It

is proposed that a leachate collector system may be required with leachate directed to the Burlington Landfill leachate transmission sewer.

4. LEACHATE QUANTITIES

Based on the results of the hydrogeological study, the rate of infiltration for the Burlington landfill (existing and expanded), is estimated at 5.7 L/min/ha for operating areas and 1.9 L/min/ha for closed areas. Assuming that site refuse were at field capacity, then these rates would be equivalent to the rate of leachate generation. Initially, a significant volume of infiltration will be absorbed by the wastes. Therefore, until field capacity is reached, leachate generation rates will be lower than the above estimated rates.

Estimates made in the January 1980 Hydrogeological Study indicate that approximately 70% of the theoretical leachate generation rate exfiltrates to the site's underlying shale. The balance, 30%, was identified as surface leakage. A toe drain collection system will be installed to control the surface discharge of leachate. For the purposes of analysis, it is assumed that the toe drain system collects 30% of the leachate produced.

It is estimated that the underdrain leachate collector system will drain approximately 90% of the leachate generated in the Phase II expansion area.

For the Falcon Creek Contingency system, a rate of 0.2 L/min/m of collector piping is estimated.

Based on these estimates, the potential leachate generation rates are shown on Table 1:

TABLE 1
BURLINGTON/BAYVIEW AREA
POTENTIAL LEACHATE GENERATION RATES
AND EQUIVALENT POPULATION

	<u>Landfill Area</u>	<u>Leachate Generation Rate</u>	<u>% Collected</u>	<u>Leachate Collection Rate</u>	<u>Equivalent Population Hydraulic</u>	<u>Organic (BOD)</u>
BURLINGTON LANDFILL						
1. <u>Existing Site</u> (including Phase I)	22 ha	1.9 L/min/ha	30%	18000 L/da	41	2470
2. Phase II	7 ha	1.9 L/min/ha	90%	17000 L/da	39	2330
3. <u>Falcon Creek Contingency System</u>		0.2 L/min/m collector length	30%	60000 L/da	140	16
TOTAL - BURLINGTON LANDFILL				95000 L/da	220	4820
BAYVIEW LANDFILL	14 ha _±	1.9 L/min/ha	30%	12000 L/da	27	1640
NATIONAL SEWER PIPE LANDFILL	28 ha	1.9 L/min/ha	*100%	77000 L/da	179	10550
TOTAL - ALL LEACHATE CONTROL FACILITIES				184000 L/da	426	17010

* Assumed percentage collection rate based on an impermeable liner and a complete underdrain system.

Should all the leachate control facilities described in Table 1 be implemented, discharge from the Falcon Creek contingency system represents 33% of the hydraulic loadings and 1% of the organic loading of the leachate produced at the Burlington landfill site.

5. CONTINGENCY PLAN

5.1 Monitoring

A program for the monitoring of surface and ground water quality has been implemented by the Region of Halton. Groundwater monitoring stations have been installed within the groundwater plume and in particular in the area where the landfill is closest to Falcon Creek. Changes in water quality as a result of leachate migration from the landfill will give sufficient lead time during which the contingency plan can be implemented. Water quality in Falcon Creek upstream and downstream of the landfill will also be monitored.

Analysis of data obtained from these on-going programs will form the basis upon which to identify the need to carry out the contingency plan. Should the result of the data analysis for the monitoring work indicate that the contingency works are necessary, then a preliminary design will be carried out to select the most effective alignment and profile. This will be based on acquisition of subsurface data identifying bedrock and groundwater configurations. Preliminary costing and system criteria will be established. Following submission to and approval by the Ministry of preliminary designs, a detailed design will be prepared including contract drawings and specifications and the project tendered for construction.

5.2 Surface Water Control

The rate of leachate generation is based on the rate of surface water infiltration. The following measures are being undertaken by the Region to minimize the rate of infiltration and thus the rate of leachate production.

i) Final Grading

The site has been finished to an average grade of 20%. These slopes promote rapid surface water runoff and thus minimize leachate production. A system of perimeter ditching is being constructed to divert drainage away from the landfill area.

ii) Site Rehabilitation

Approximately 1.5 m of clay tills have been applied to finished areas. During 1981 these areas will be top-soiled and seeded to further reduce infiltration.

Through these measures, the rate of leachate generation will be kept to lowest practical levels.

5.3 Leachate Control

A toe drain leachate collector system has been installed at the perimeter of the landfilling area on the Falcon Creek side of the site. The performance of the system is being monitored by the Region. The quantity and quality of leachate will be recorded at regular intervals. A program of

routine maintenance will be undertaken to ensure that leachate drains freely to the sanitary sewer system.

5.4 Ground Water Control

The implementation of a contingency plan for ground water control in the Falcon Creek Ravine is premised on the identification of water quality impairments in Falcon Creek. This would result if leachate migrates via ground water flow paths, to the Creek. A ground water interceptor system, installed below the water table in the area between the Creek and the landfill, would create a localized drawdown and thus, intercept flow from the landfill to the Creek.

Based on the hydrogeological-geotechnical study, overburden thickness varies generally between 0.3 to 2.0 m. It is estimated that the interceptor would be installed at depths less than 3 m and would be lower than the Creek bottom. It is estimated that the ground water discharge rate is 0.2 L/min/m collector length. Concepts for a ground water control system are discussed in Section 6.

6. SYSTEM CONCEPTS

6.1 Interceptor Collector

A ground water interceptor drain would be installed in the low-lying areas of Falcon Creek. A typical alignment is shown on Figures 1, 2 and 3. It is estimated that approximately 210 m of perforated collector drains would be required and would be installed at depths of 3 m. The collector would be keyed into shale and would be below the low ground water table. A subsurface investigation program would provide data upon which to base the detailed design of the collector. The profile and alignment would be adjusted so that excavation depths and thus costs are minimized.

6.2 Disposal and Treatment

There are three options available for the disposal and treatment of the collected ground water.

- i) Discharge to the leachate transmission sewer on the North Service Road (see Figure 1).
- ii) Discharge to the leachate collector system in the southwest area of the existing landfill (see Figure 2).
- iii) Recharge to the southwest area of the existing landfill (see Figure 3).

6.2.1 Discharge to Leachate Transmission Sewer

Discharge by gravity to the sewer may be achieved by extending the system along Falcon Creek to the North Service Road. Approximately 370 m of sewer would be required and would be installed at depths between 2 to 3 m. Extensive clearing and grubbing is required.

6.2.2 Discharge to the Leachate Collection System

Discharge to a manhole on the leachate collection system would be achieved by installing a pumping station and forcemain at the end of the interceptor piping. It is estimated that approximately 75 m of forcemain would be required. Minimal clearing and grubbing is required since the area has been previously prepared for a power transmission line.

6.2.3 Recharge to the Existing Landfill

Recharge to the southwest area of the present landfill would be achieved with the construction of two pumping stations, two recharge wells, and approximately 210 m of forcemain. The discharge of mildly contaminated ground water to the sanitary sewer system would add 60000 L/day of influent flow to the Burlington Skyway WPCP. BOD concentrations of these discharges, however, would be approximately equivalent to levels for final effluent from the plant. It is recommended, therefore, that pumping of intercepted ground water into the

existing landfill be carried out to reduce the discharge of "clean" water to the Burlington sanitary sewer system. A theoretical flow reduction of 40000 L/day would be achieved.

Should the area from the Burlington landfill to the Bayview landfill become fully developed for landfilling and significant organic loadings result from the discharge of leachate from these facilities, future consideration should be given to the installation of pretreatment facilities for flow reduction and organic reduction.

6.3 Future Interceptor Extensions

The primary area identified for ground water interception is an area 210 m $\pm$ along Falcon Creek and opposite the southwest part of the present landfill.

The Creek is closest to the landfill in this area, thus the first indications of leachate leakage to the Creek would be expected there.

Should future monitoring of ground and surface water identify that the ground water interceptor needs to be extended to the Phase I and Phase II areas of the site, an alignment permitting gravity flow for the extended system can be selected. Suggested alignments are shown on Figures 1, 2 and 3.

The system could be extended by 1000 m $\pm$; however, ground water collected would increase by 500%.

7. COSTS

7.1 General Assumptions

Should implementation of the leachate contingency plan proceed, the preparation of a pre-design report to establish design criteria and the preparation of a detailed design will be carried out to describe the detailed configuration of the system. At that time, detailed cost estimates will be prepared. At this stage, for the purposes of comparison, costs are based on assumptions made for each alternative concept. Allowances have been made for minimal rock excavation.

The degree of restoration required may vary from topsoil and seed only to extensive plantings to promote the return to the former vegetative character of the valley.

7.2 Ground Water Interceptor

Estimated costs for the construction of 210 m⁺ of ground water interceptor are \$75,000. This includes allowances for engineering and contingencies as well as a minimal amount of rock excavation. An allowance has been made for topsoil, seeding and mulch; however, should full restoration be required, including tree planting, an additional estimated amount of \$20,000 would be required.

7.3 Disposal and/or Treatment

7.3.1 Discharge to Leachate Collector System

Shown on Figure 2, a pumping station and forcemain would carry the collected ground water to the nearest manhole in the leachate collector system. Estimated costs, including engineering and contingencies, are \$55,000. These works would be constructed within the Ontario Hydro easement. This area has been previously cleared, therefore, restoration would consist of topsoil, seed and mulch.

7.3.2 Discharge to Sanitary Sewer on North Service Road

Shown on Figure 1, a transmission sewer would be constructed east of Falcon Creek and would discharge ground water from the interceptor to the sewer by gravity. Estimated costs of these works, including engineering and contingencies and a minimal amount of rock excavation, is \$105,000. Restoration would consist of topsoil, seed and mulch. Should full restoration be required, including tree planting, then an estimated additional \$40,000 in costs would be incurred.

7.3.3 Recharge to the Landfill

Shown on Figure 3, this system would comprise the construction of two pumping stations, two recharge wells, and forcemains linking the pumping stations and recharge wells. Estimated costs, including engineering and contingencies, are \$105,000. These works would be constructed within the Ontario

Hydro easement and the southwest area of the present land-fill, therefore, restoration would consist of topsoil, seed and mulch.

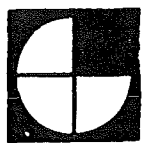
8. CONCLUSIONS AND RECOMMENDATIONS

Ground water and surface water monitoring programs have been implemented at the Burlington Landfill.

The construction of a ground water interceptor drain, installed between the landfill and the Creek, would result in the collection of 0.2 L/min/m of pipe length. Since these flows have a high hydraulic impact on the Water Pollution Control Plant that they discharge to, it is recommended that collected ground water be recharged into the landfill. This measure will prevent the discharge of mildly contaminated ground water to the sanitary sewer system.

It is recommended that ground and surface water monitoring continue and that data collected be used to assess ground water impacts on Falcon Creek. Prior to any decision to implement the ground water interceptor system, these impacts will be reviewed with respect to the Ministry of the Environment's water quality objectives.

APPENDIX "A"



**Gartner
Lee
Associates Limited**

Consulting
Engineering
Geologists and
Hydrogeologists

Toronto - Buttonville Airport ■ Markham, Ontario ■ L3P 3J9 ■ 416-297-4600

HYDROGEOLOGICAL - GEOTECHNICAL STUDY REPORT
CONTINGENCY LEACHATE COLLECTION SYSTEM
BURLINGTON LANDFILL SITE
FOR
M. M. DILLON LIMITED

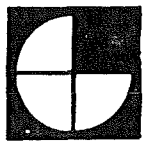
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August 14th, 1980

M. M. Dillon Limited,
P.O. Box 219,
Station 'K',
Toronto, Ontario.
M4P 2G5

Attention: Mr. H. Bourque, P.Eng.

Dear Sirs:

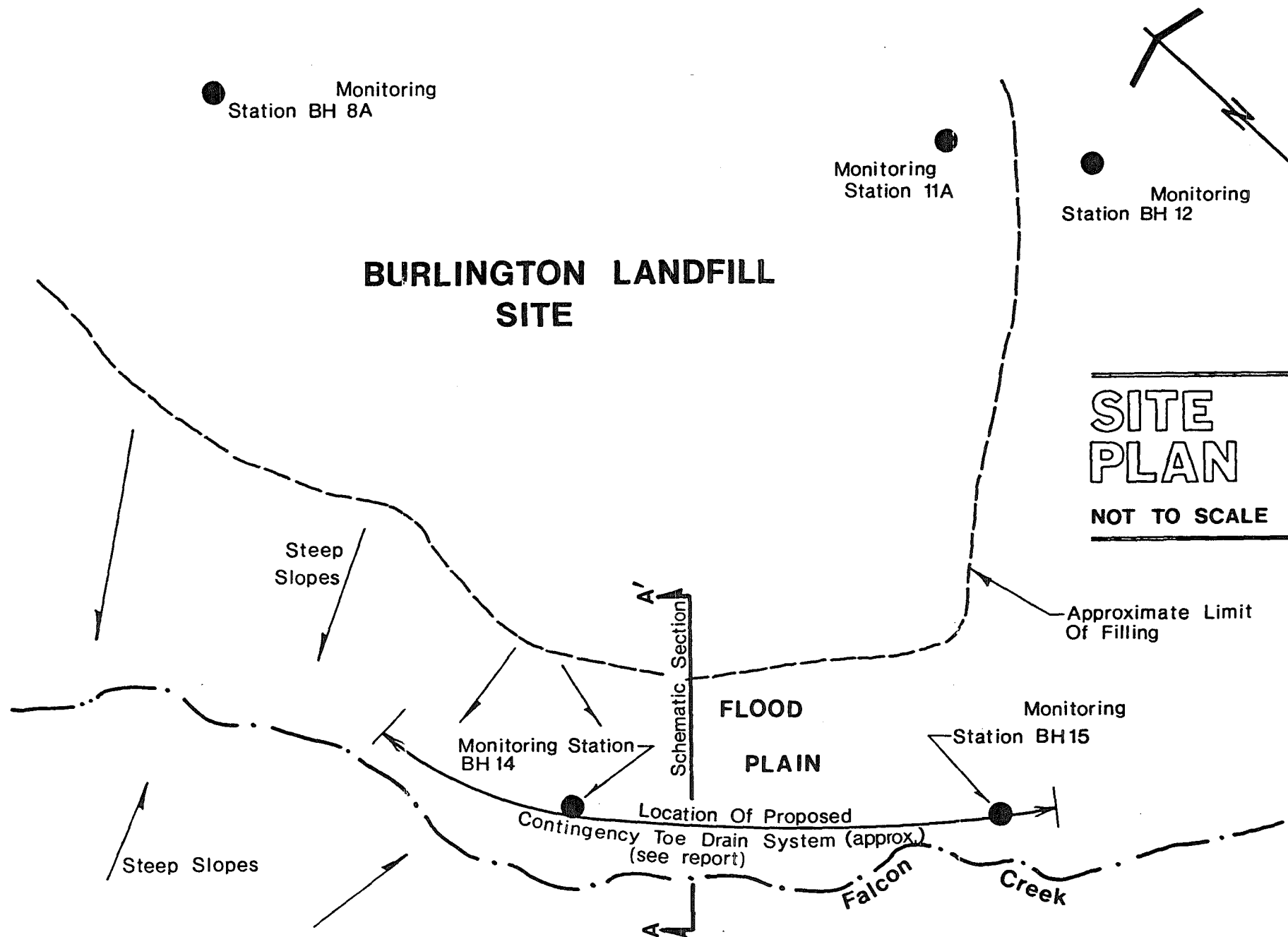
Re: Hydrogeological - Geotechnical Study,
Contingency Leachate Collection System
Burlington Landfill Site

We respectfully submit our hydrogeological - geotechnical letter report for the above-noted study as per your verbal request. The purpose of the study is to assist M. M. Dillon Limited with the preparation of a preliminary design concept for the contingency system. The design work is being conducted to satisfy a condition on the Provisional Certificate of Approval for the Phase 1 expansion at the Burlington Landfill Site.

At this time, we feel that a conceptual design is sufficient. A final design could be prepared if the ground and surface water monitoring program indicates that leachate migrating from the landfill is creating a water quality problem in Falcon Creek.

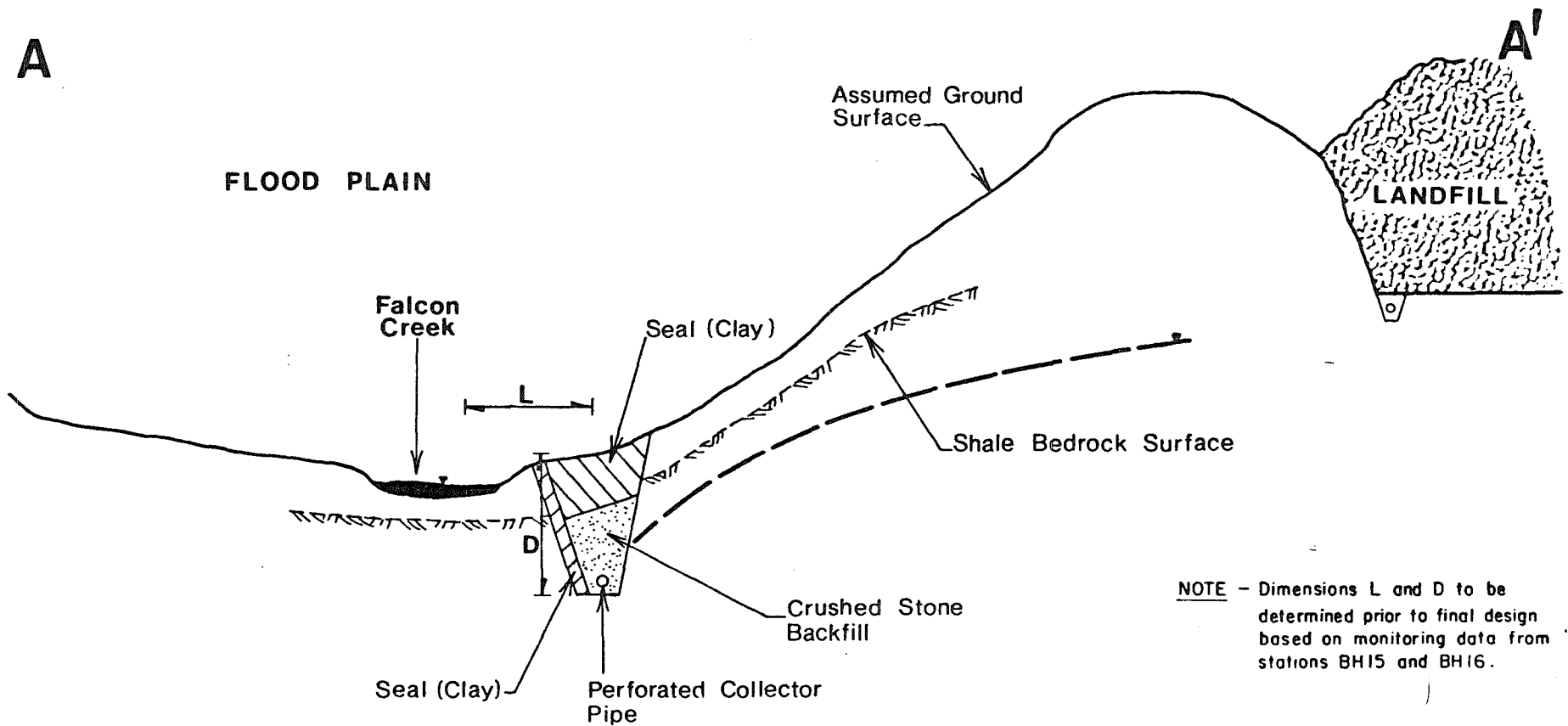
In this regard, we will be installing two ground water monitoring stations between the landfill and the creek at the locations shown on the enclosed site plan sketch. This work will be undertaken in the near future. These stations will comprise two monitors, a standpipe to measure water table conditions and shallow ground water quality; and a piezometer to measure water pressure and ground water quality at depth.

continued -



Schematic Cross Section A-A'

Contingency Toe Drain Collector System



NOT TO SCALE

NOTE - Dimensions L and D to be determined prior to final design based on monitoring data from stations BH15 and BH16.

As recommended in our monitoring program report for the Burlington Landfill Site (GLAL 80-39), we will check water quality in these installations commencing this Fall. The current program will continue for one year initially and involves the testing for conductivity, pH, chloride, sulphate, phenol and BOD at each sampling location. At the same time, we will monitor water quality in Falcon Creek at stations up and down-gradient of the expansion area. Details of the program are outlined in our report 80-39.

One of the purposes of the monitoring program discussed above is to assess any impact the landfilling operation has on the ground and surface water quality. Thus, if the program indicates a deterioration in water quality in Falcon Creek or the monitors between the site and the creek, then the situation would be investigated to obtain parameters to permit final design of the contingency system.

Conceptually, the system would consist of a perforated drain pipe bedded in a trench backfilled with clear crushed stone. The depth of this interceptor drain and horizontal alignment will depend on the results of ground water flow data from the monitors and thus will be decided if the system is required. In order to control ground water recharge from the creek into the collector pipe we suggest that the creek side of the trench be lined with a slowly permeable membrane or liner such as clay. As well to reduce surface water and shallow ground water infiltration, the stone backfill should be capped with clay. This clay seal should extend to the bedrock contact. See the enclosed schematic cross-section for conceptual details.

From ground water flow information, we have estimated that the interceptor drain as described herein would collect ground water at a rate of .2 litres/min/m of length. We have assumed infiltration from only one side i.e. the landfill side for calculation purposes. Quantities would approximately double if infiltration from the creek side of the trench was included.

continued -

Page 3.
M. M. Dillon Limited,
August 14th, 1980.

The quality of the intercepted ground water will probably reflect the down-gradient quality observed in GLAL borehole 12 monitors. Geochemical analysis indicates BOD levels between 6 and 30 ppm, sulphates around 1500 ppm, hardness 1700 ppm, chlorides 300 ppm, sodium 350 ppm, iron 4 to 9 ppm and kjeldahl nitrogen 1.5 to 1.8 ppm. These concentrations represent only limited results over a short period of time and thus should be considered a guide to possible water quality which might be collected in the system.

We trust that these comments will assist with your design functions. If there are any questions, please feel free to contact us.

Yours very truly,

GARTNER LEE ASSOCIATES LIMITED



D. E. Jagger, P.Eng.,
Senior Project Engineer

DEJ/sv