Court File No: 811/89

SUPREME COURT OF ONTARIO
(DIVISIONAL COURT)

B E T W E E N:

THE MILTON AREA CITIZENS COALITION, THE HALTON FEDERATION OF AGRICULTURE, WATKIN AND DOREEN MARTIN, WALTER TOMOSKY, THOMAS AND MARY-JEAN MARTIN, MICHAEL AND CYNTHIA REED, GRAHAM AND EVELYN GILLIES, SALLY VERTULIA, RAY AND ANNETTE WINTER, KIP AND ANNE CHAPUT, WILFRED AND FREDA LAWRENCE, BILL AND BEVERLEY KETELAARS, JOHN VITETTA, STEVE AND SHIRLEY DOLBY, KEN WETTLAUFER, HOWARD GOWLAND, MR. AND MRS. PIETRO MOSCATO, MR. AND MRS. L. CIACCO, RICK AND COLLEEN SIMMONS, MR. AND MRS. ALBERTA SILVA

APPLICANTS

- and -

THE JOINT BOARD (ESTABLISHED UNDER SECTION 4 OF THE CONSOLIDATED HEARINGS ACT, 1981, S.O. 1981, C.20, AS AMENDED), THE REGIONAL MUNICIPALITY OF HALTON, THE CORPORATION OF THE TOWN OF MILTON, THE CORPORATION OF THE CITY OF BURLINGTON, NSP INVESTMENTS LIMITED, THE WEST BURLINGTON CITIZENS' GROUP AND THE HONOURABLE JAMES BRADLEY, IN HIS CAPACITY AS THE MINISTER OF THE ENVIRONMENT

RESPONDENTS

APPLICATION RECORD

GARROD ASSOCIATES
Lawyers
337 Woolwich Street
Guelph, Ontario, N1H 3W4

Stephen Garrod
(519) 837-0500

Solicitors for the Applicants

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5.	Excerpt from Exhibit H-5, Compilation of Applications and Submissions - Definition of Undertaking (revised)		E
6.	Exhibit H-13, Stage 2C: Evaluation and Summary Report Cover Page and Pages 20 to 21	June, 1985	F
7.	Exhibit E-154, Ministry of the Environment Policy 15-08, "Incorporation of the Reasonable Use Concept into M.O.E. Groundwater Management Activities" and Implementation Guideline.		G
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Court File No:

SUPREME COURT OF ONTARIO
(DIVISIONAL COURT)

BETWEEN:

THE MILTON AREA CITIZENS COALITION, THE HALTON FEDERATION OF AGRICULTURE, WATKIN AND DOREEN MARTIN, WALTER TOMOSKY, THOMAS AND MARY-JEAN MARTIN, MICHAEL AND CYNTHIA REED, GRAHAM AND EVELYN GILLIES, SALLY VERTULIA, RAY AND ANNETTE WINTER, KIP AND ANNE CHAPUT, WILFRED AND FREDA LAWRENCE, BILL AND BEVERLEY KETELAARS, JOHN VITETTA, STEVE AND SHIRLEY DOLBY, KEN WETTLAUFER, HOWARD GOWLAND, MR. AND MRS. PIETRO MOSCATO, MR. AND MRS. L. CIACCO, RICK AND COLLEEN SIMMONS, MR. AND MRS. ALBERTA SILVA

APPLICANTS

- and -

THE JOINT BOARD (ESTABLISHED UNDER SECTION 4 OF THE CONSOLIDATED HEARINGS ACT, 1981, S.O. 1981. C.20, AS AMENDED), THE REGIONAL MUNICIPALITY OF HALTON, THE CORPORATION OF THE TOWN OF MILTON, THE CORPORATION OF THE CITY OF BURLINGTON, NSP INVESTMENTS LIMITED, THE WEST BURLINGTON CITIZENS' GROUP AND THE HONOURABLE JAMES BRADLEY, IN HIS CAPACITY AS THE MINISTER OF THE ENVIRONMENT

RESPONDENTS

Application under the Judicial Review Procedure Act, R.S.O. 1980, c.224, Subsections 2(1), 2(3) and 2(4) and Rule 68 of the Rules of Civil Procedure.

NOTICE OF APPLICATION FOR JUDICIAL REVIEW

TO THE RESPONDENTS:

A LEGAL PROCEEDING HAS BEEN COMMENCED by the applicants.

The claim made by the applicants appears on the following pages.

THIS APPLICATION for judicial review will come on for a hearing before the Divisional Court on a date and a place to be fixed by the Registrar of the Divisional Court. The applicants request that this application be heard at Toronto, Ontario.

IF YOU WISH TO OPPOSE THIS APPLICATION, you or an Ontario lawyer acting for you must forthwith prepare a notice of appearance in Form 38C prescribed by the Rules of Civil Procedure, serve it on the applicants' lawyer and file it, with proof of service, in the office of the Divisional Court, and you or your lawyer must appear at the hearing.

IF YOU WISH TO PRESENT AFFIDAVIT OR OTHER DOCUMENTARY EVIDENCE TO THE COURT OR TO EXAMINE OR CROSS-EXAMINE WITNESSES ON THE APPLICATION, you or your lawyer must, in addition to serving your notice of appearance, serve a copy of the evidence on the applicants' lawyer and file it, with proof of service, in the office of the Divisional Court within thirty days after service on you of the applicants' application record, or not later than 2 p.m. on the day before the hearing, whichever is earlier.

IF YOU FAIL TO APPEAR AT THE HEARING, JUDGMENT MAY BE GIVEN IN YOUR ABSENCE AND WITHOUT FURTHER NOTICE TO YOU.

Date: August 4, 1989 Issued by _____

Registrar
Divisional Court
Osgoode Hall
130 Queen Street West
Toronto, Ontario
M5H 2N5

TO: The Joint Board
Office of Consolidated Hearings
2300 Yonge Street
P.O. Box 2382
Suite 1201
Toronto, Ontario, M4P 1E4

AND TO: The Regional Municipality of Halton
c/o T.R. Lederer and N.D. Hodgson
Osler, Hoskin & Harcourt
Barristers & Solicitors
P.O. Box 50
First Canadian Place
Toronto, Ontario, M5X 1B8

AND TO: The Corporation of the City of Burlington
c/o M.J. McQuaid, Q.C.
Weir & Foulds
Suite 1600
Exchange Tower
Box 480
2 First Canadian Place
Toronto, Ontario, M5X 1J5

AND TO: The Corporation of the Town of Milton
c/o F.E. Leitch
O'Connor, Leitch, Hays, Gangbar & Sheridan
Barristers & Solicitors
300 Hopedale Mall
Third Line & Rebecca Street
Oakville, Ontario
L6L 5G8

AND TO: The West Burlington Citizens Group
c/o Toby Vigod
Canadian Environmental Law Association
4th Floor
243 Queen Street West
Toronto, Ontario, M5V 1Z4

AND TO: N.S.P. Investments Limited
c/o E. Cronk and L. Griffiths
Fasken & Calvin
30th Floor, Box 30
Toronto-Dominion Centre
Toronto, Ontario, M5K 1C1

AND TO: The Honourable James Bradley,
In His Capacity as the
Minister of the Environment
c/o Ms. Bonnie J. Wein
Director of Legal Services
Ministry of the Environment
11th Floor
135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

AND FURTHER TO:

The Attorney General of Ontario
c/o Thomas Marshall, Q.C.
Director, Crown Law Office - Civil
8th Floor
720 Bay Street
Toronto, Ontario, M5G 2K1

AND TO FURTHER TO:

Azova Investments Limited
c/o Robert M. Fishlock
Blake, Cassels & Graydon
Barristers & Solicitors
Box 25
Commerce Court West
Toronto, Ontario, M5L 1A9

AND FURTHER TO:

The Honourable Vincent Kerrio
Minister of Natural Resources
c/o C. Mansfield
Whitney Block
Queen's Park
Toronto, Ontario, M7A 1W3

AND FURTHER TO:

Cumis Limited
P.O. Box 5065
151 North Service Road
Burlington, Ontario, L7R 4C2

AND FURTHER TO:

Halton Region Conservation Authority
c/o J.H. Olah
Beard, Winter
Barristers & Solicitors
9th Floor
150 King Street West
Toronto, Ontario, M5H 2K4

APPLICATION

1. The applicants make application for:

(a) an Order quashing the decision of the Joint Board dated February 24, 1989, as amended March 2, 1989, which rejected the applications by the Regional Municipality of Halton (Halton) for approval under the Environmental Assessment Act and other legislation to proceed with landfilling at Site F and approved Halton's applications for approval to proceed with landfilling at Site D, subject to the Conditions set out in the decision of the Joint Board, and which directed the Approvals Director to issue a Certificate of Approval in accordance with the said Conditions, pursuant to Section 38 of the Environmental Protection Act, R.S.O. 1980, c.141; and,

(b) an Order quashing the decision of the Joint Board dated February 24, 1989, as amended March 2, 1989, which determined that approval would be granted pursuant to

Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1989, c.148 to acquire the lands at Site D, including the homes and properties of Watkin and Doreen Martin, Walter Tomosky, Thomas and Mary Jean Martin and Michael and Cynthia Reed for constructing, operating and maintaining a landfill site in the Region of Halton;

(c) in the alternative, an Order remitting the matters referred to in subparagraphs (a) and (b) herein back to the Joint Board for re-hearing and reconsideration in accordance with proper legal principles and the rules of natural justice;

(d) an interim Order staying the decisions of the Joint Board set out in (a) and (b) above pending the hearing of this application; and

(e) such further and other relief as counsel may advise and this Honourable Court may permit.

2. The grounds for the application are:

(a) there was no evidence before the Joint Board that Site F, with an engineered liner, was hydrogeologically "unsuitable" or "unacceptable" for landfilling;

(b) there was no evidence before the Joint Board that Site F, with an engineered liner, was otherwise "unacceptable" in the Public Health and Safety category for landfilling;

(c) the Joint Board, in concluding that Site F was hydrogeologically "unsuitable" and "unacceptable" for landfilling with an engineered liner, rejected the uncontroverted evidence of every hydrogeologist who testified before the Joint Board;

(d) the Joint Board acted arbitrarily and in so doing exceeded its jurisdiction and breached the rules of natural justice in that it:

(i) rejected, without making adverse credibility findings against them, the uncontroverted expert evidence of the hydrogeology witnesses, all of whom testified that Site F was acceptable and suitable for landfilling with an engineered liner;

(ii) substituted its own opinion, in the absence of any supporting expert hydrogeological evidence therefor, regarding the hydrogeological suitability of Site F, for the opinions of all the expert hydrogeologists who testified before it;

(iii) developed its own criteria for acceptability, without disclosure to and without affording the parties to be affected thereby an opportunity to make comment thereon, and relied on its own criteria for determining the hydrogeological suitability of a proposed site for landfilling, in making its decision;

(iv) failed, in making its decision, to take into account relevant evidence regarding the hydrogeological characteristics of Site F.

(e) The Joint Board erred in purporting to grant approval to acquire the lands of Watkin and Doreen Martin, Walter Tomosky, Thomas and Mary Jean Martin and Michael and Cynthia Reed, pursuant to the Expropriations Act, without proper regard to whether it was "fair, sound and reasonably necessary" to do so to achieve the Halton's objective, that is, to gain approval for a sanitary landfill site to serve the Regional Municipality of Halton.

(f) In the alternative to paragraph (e), the Joint Board erred in concluding, according to standards of its own creation, that Halton's preferred site, Site F, which does not require the expropriation of any property owners against their will, was not an acceptable alternative site thereby

making the approval of Site D "fair, sound and reasonably necessary" by default.

(g) Such further and other grounds as counsel may advise and this Honourable Court may permit.

3. The following documentary evidence will be used at the hearing of the application:

(a) The record to be filed by the Joint Board pursuant to Section 10 of the Judicial Review Procedure Act, R.S.O. 1980, c.224; and

(b) Such further and other material as counsel may advise and this Honourable Court may permit.

Date: August 4, 1989

GARROD ASSOCIATES
Lawyers
337 Woolwich Street
Guelph, Ontario, N1H 3W4

Stephen Garrod

(519) 837-0500

Solicitor for the
Applicants

MILTON AREA CITIZENS' COALITION ET AL and THE JOINT BOARD ET AL

Applicants Respondents

Court File No.

SUPREME COURT OF ONTARIO
(DIVISIONAL COURT)
Proceeding commenced at Toronto

NOTICE OF APPLICATION FOR JUDICIAL REVIEW

GARROD ASSOCIATES, Lawyers
337 Woolwich Street
Guelph, Ontario, N1H 3W4

Stephen Garrod
(519) 837-0500

Solicitor for the Applicants

Court File No. 661/89

SUPREME COURT OF ONTARIO
(DIVISIONAL COURT)

THE HONOURABLE MR. JUSTICE STEELE	))))	MONDAY, THE 21st DAY OF AUGUST, 1989

B E T W E E N:

NSP INVESTMENTS LIMITED

Applicant

-and-

THE JOINT BOARD (ESTABLISHED UNDER SECTION 4 OF THE CONSOLIDATED HEARINGS ACT, 1981, S.O. 1981, c. 20, AS AMENDED), THE REGIONAL MUNICIPALITY OF HALTON, THE CORPORATION OF THE TOWN OF MILTON, THE CORPORATION OF THE CITY OF BURLINGTON, THE WEST BURLINGTON CITIZENS' GROUP, THE MILTON AREA CITIZENS' COALITION, THE HALTON FEDERATION OF AGRICULTURE, WATKIN AND DOREEN MARTIN, WALTER TOMOSKY, THOMAS AND MARY-JEAN MARTIN, MICHAEL AND CYNTHIA REED, AND THE HONOURABLE JAMES BRADLEY, IN HIS CAPACITY AS THE MINISTER OF THE ENVIRONMENT

Respondents

Application under the Judicial Review Procedure Act, R.S.O. 1980, c. 224, Subsections 2(1), 2(3) and 2(4) and Rule 68 of the Rules of Civil Procedure

O R D E R

THIS MOTION, made by the Applicant NSP Investments Limited for an order for directions with respect to the content of the Record to be filed by the Joint Board with the Registrar pursuant to section 10 of the *Judicial Review Procedure Act*, R.S.O. 1980, c.224 for the purpose of this Application was heard this day at Osgoode Hall.

ON HEARING the submissions of counsel for the Applicant, and on the consent of the parties,

1. THIS COURT ORDERS that the Record to be filed by the Joint Board in this Application need not be filed until after the delivery of all *facta* by the parties.

Registrar, Divisional Court

INSCRIT À/ENTERED AT TORONTO
IN FILM No.: 789
DANS FILM No.:
ON/LE: OCT 11 1989
AS DOCUMENT No.: 956
EN TANT QUE DOCUMENT No.:
PER/PAR:

NSP INVESTMENTS LIMITED - and - THE JOINT BOARD, ET AT
(UNDER THE *CONSOLIDATED HEARINGS ACT*)

Applicant Respondent

Court File No. 661/89

SUPREME COURT OF ONTARIO
(Divisional Court)

Proceedings commenced at Toronto

ORDER

FASKEN & CALVIN
Barristers & Solicitors
P.O. Box 30
Toronto Dominion Bank Tower
Toronto-Dominion Centre
Toronto, Ontario
M5K 1C1

Eleanore A. Cronk
Leonard J. Griffiths

(416) 366-8381

Solicitors for the Applicant

Court File No. 661/89 (11)

SUPREME COURT OF ONTARIO
(DIVISIONAL COURT)

THE HONOURABLE MR. JUSTICE McKEOWN	)	TUES DAY, THE 31ST DAY OF OCTOBER ~~SEPTEMBER~~, 1989

BETWEEN:

NSP INVESTMENTS LIMITED

Applicant

-and-

THE JOINT BOARD (ESTABLISHED UNDER SECTION 4 OF THE CONSOLIDATED HEARINGS ACT, 1981, S.O. 1981, c. 20, AS AMENDED), THE REGIONAL MUNICIPALITY OF HALTON, THE CORPORATION OF THE TOWN OF MILTON, THE CORPORATION OF THE CITY OF BURLINGTON, THE WEST BURLINGTON CITIZENS' GROUP, THE MILTON AREA CITIZENS' COALITION, THE HALTON FEDERATION OF AGRICULTURE, WATKIN AND DOREEN MARTIN, WALTER TOMOSKY, THOMAS AND MARY-JEAN MARTIN, MICHAEL AND CYNTHIA REED, AND THE HONOURABLE JAMES BRADLEY, IN HIS CAPACITY AS THE MINISTER OF THE ENVIRONMENT

Respondents

Application under the Judicial Review Procedure Act, R.S.O. 1980, c. 224, Subsections 2(1), 2(3) and 2(4) and Rule 68 of the Rules of Civil Procedure

ORDER

THIS MOTION, made by the Applicant for an order to have Applications numbered 661/89, 773/89 and 811/89 heard together and for an order that the Order dated August 21, 1989 made by the Honourable Mr. Justice Steele apply to all three applications, and for an order requiring that

only one Record, to be used on the argument of all three said Applications, be filed by the Joint Board and that it be filed in Application numbered 661/89, was read this day at Osgoode Hall.

ON READING the consents of the parties filed,

1. THIS COURT ORDERS that Applications numbered 661/89, 773/89 and 811/89 be heard together;

2. THIS COURT ORDERS that the Order dated the 21st day of August, 1989 made in Application numbered 661/89 by The Honourable Mr. Justice Steele, shall apply to all of the Applications numbered 661/89, 773/89 and 811/89; and

3. THIS COURT ORDERS that only one Record be filed by the Joint Board, to be used on the argument of all three of the Applications numbered 661/89, 773/89 and 811/89, and that the said Record shall be filed in Application numbered 661/89.

Registrar, Divisional Court

INSCRIT À/ENTERED AT
TORONTO
IN FILM No.:
DANS FILM No.: 792
ON/LE: NOV - 2 1989
AS DOCUMENT No.: 111
EN TANT QUE DOCUMENT No.:
PER/PAR:

NSP INVESTMENTS LIMITED - and - THE JOINT BOARD, ET AT
(UNDER THE *CONSOLIDATED HEARINGS ACT)*

Applicant

Respondent

Court File No. 661/89

SUPREME COURT OF ONTARIO
(Divisional Court)

Proceedings commenced at Toronto

ORDER

FASKEN & CALVIN
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Eleanore A. Cronk
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Solicitors for the Applicant

LIST OF RELEVANT TRANSCRIPTS

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SCHEDULE "A" to Report CAO 262/86

Definition of the Undertaking - Unamended

The original Undertaking for which the Regional Municipality of Halton seeks approval is defined in Halton's Environmental Assessment for the Landfill Component of Halton's Solid Waste Management System, October, 1985 on page S1 as follows:

> "... to landfill in Halton 11.3 million cubic yards of solid waste, and to do so by one of two alternative methods:
>
> i) landfilling at the site commonly referred to as Site F in the City of Burlington, as set out in Map A, attached hereto, or
>
> ii) landfilling at the site commonly referred to as Site D in the Town of Milton, as set out in Map B, attached hereto."

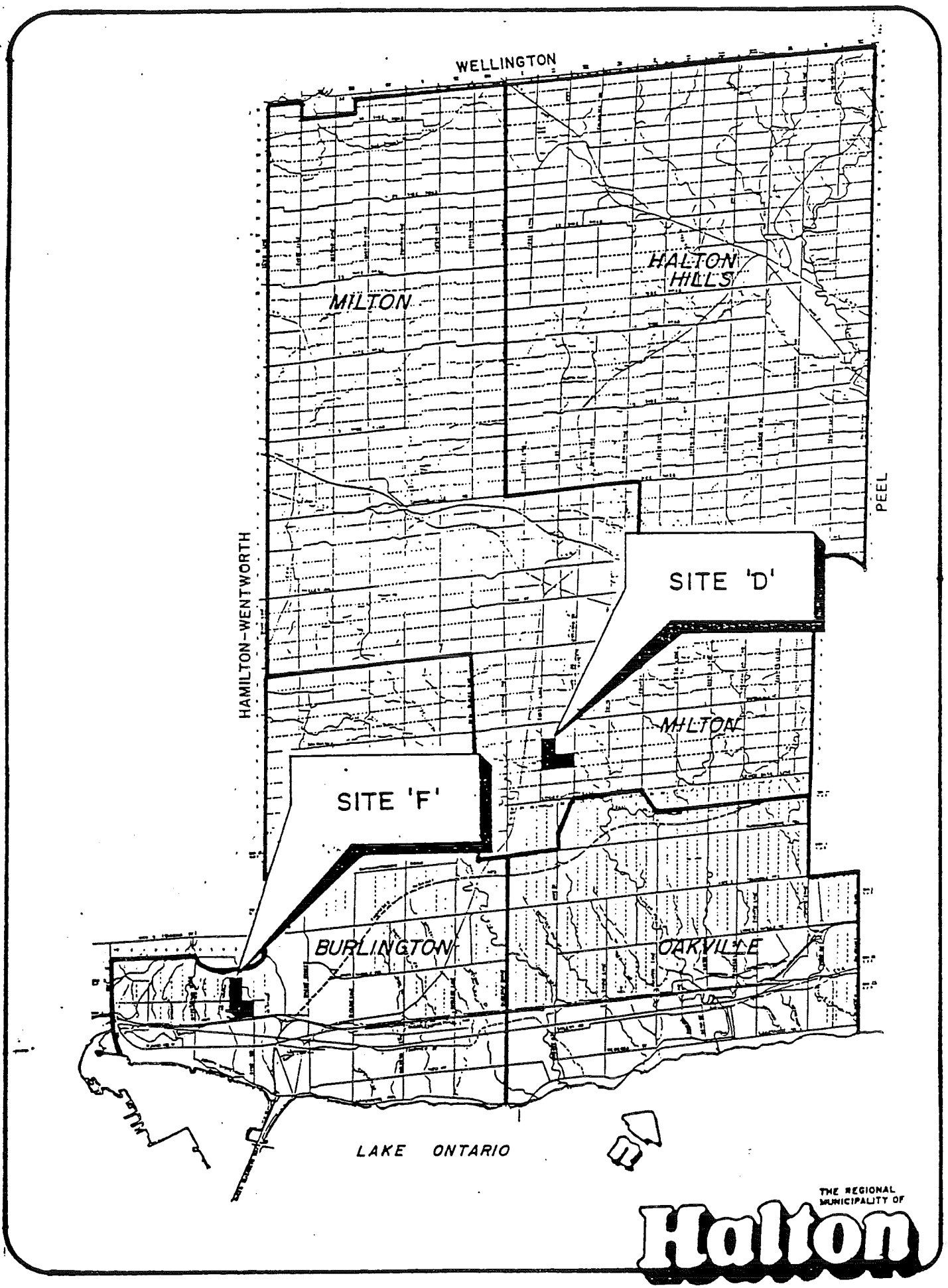
Definition of the Undertaking - Amendment

As a result of the more detailed site specific investigations carried out by Halton during its Landfill Technical Study, refinements were made to waste projections and the site plan areas.

The definition of the Undertaking should therefore be amended to reflect these updated projections and requirements.

The revised definition of Halton's undertaking for which it seeks approval under the Environmental Assessment Act is:

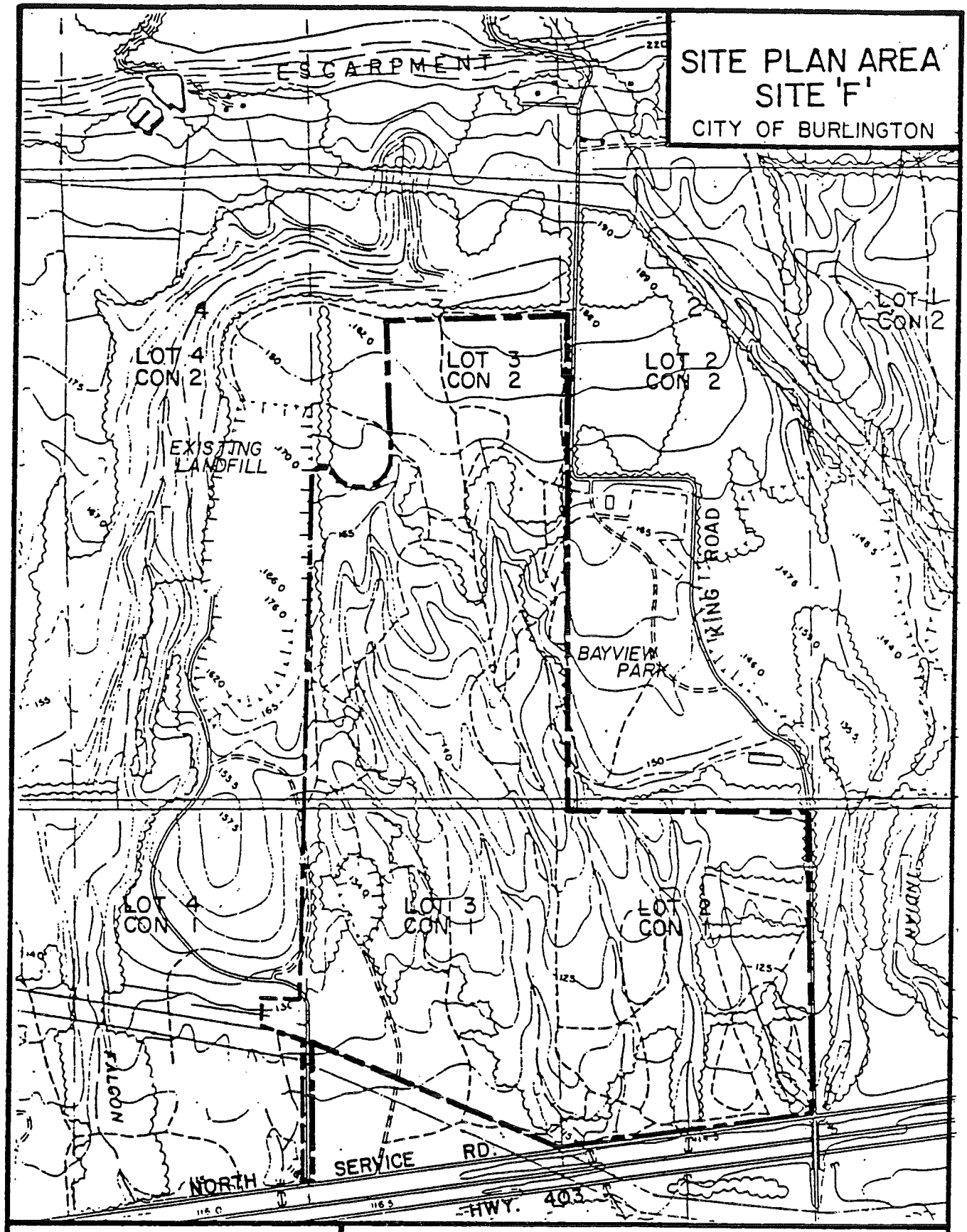
> "The undertaking is to acquire land for, construct, operate and maintain a landfill to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton and to do so by one of two alternative methods as follows:
>
> i) landfilling at the site referred to in Halton's Environmental Assessment as Site F, in the City of Burlington, as shown on Maps A and B hereto; or
>
> ii) landfilling at the site referred to in Halton's Environmental Assessment as Site D, in the Town of Milton, as shown on Maps A and C hereto."

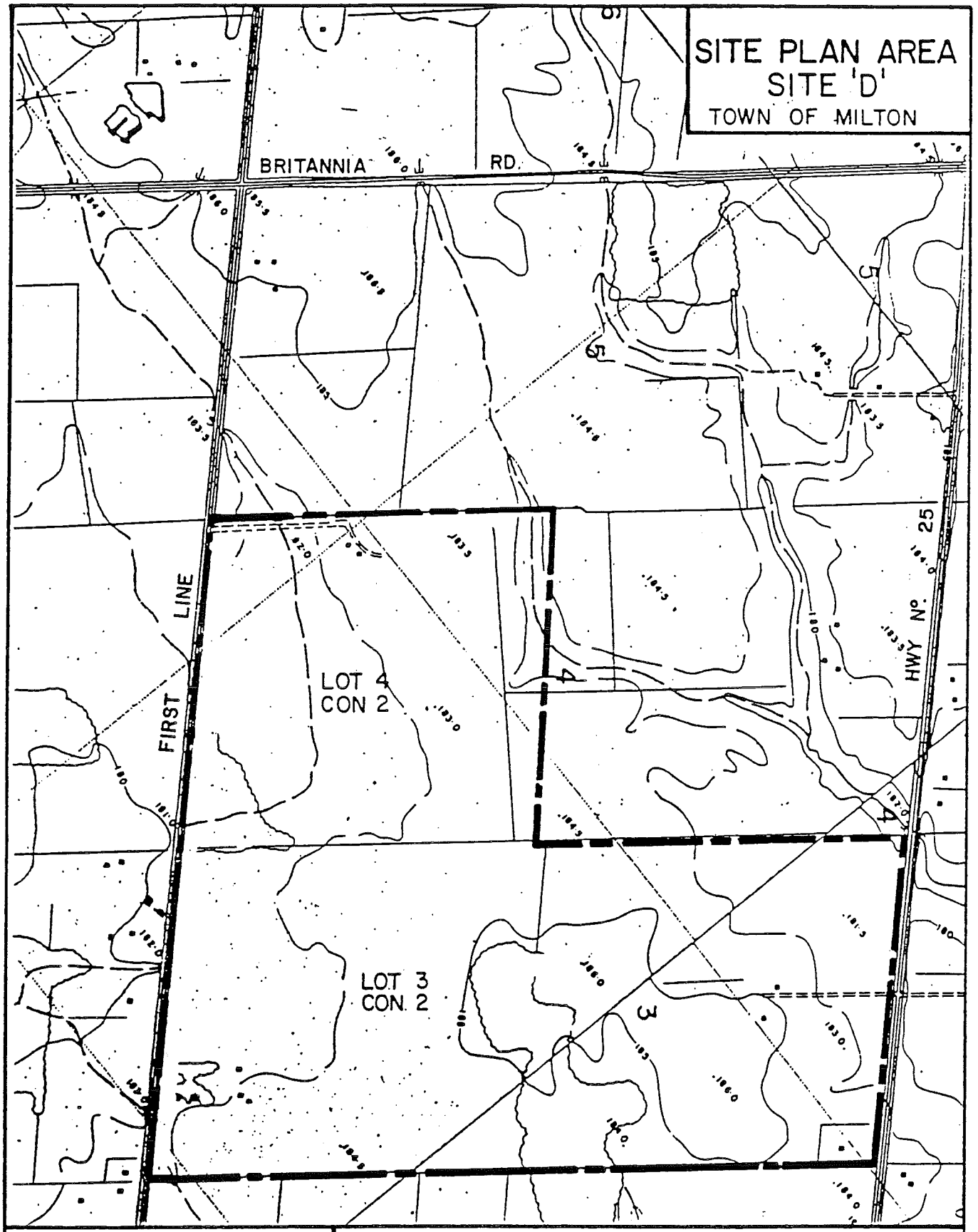


THE REGIONAL MUNICIPALITY OF

Halton

MAP A


SITE PLAN AREA
SITE 'F'
CITY OF BURLINGTON
ESCARPMENT
LOT 4
CON 2
LOT 3
CON 2
LOT 2
CON 2
LOT 1
CON 2
EXISTING
LANDFILL
KING ROAD
BAYVIEW
PARK
LOT 4
CON 1
LOT 3
CON 1
LOT 2
CON 1
INDIAN
FALCON
SERVICE RD.
NORTH
HWY. 403
LEGEND
SITE PLAN AREA
BOUNDARY
ENVIRONMENTAL ASSESSMENT OF THE LANDFILL
COMPONENT OF HALTON'S SOLID WASTE
MANAGEMENT SYSTEM
SCALE: 1:10 000
DATE: OCT. 1986
MAP 8



LEGEND

SITE PLAN AREA BOUNDARY

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

SCALE: 1:10 000 *DATE:* OCT. 1986 MAP C

S

H-13

FINAL REPORT
PHASE 2 STAGE 2C
SELECTION OF PREFERRED SITE

EVALUATION AND SUMMARY REPORT

WALKER WRIGHT YOUNG ASSOCIATES LIMITED

HALTON

ENVIRONMENTAL
ASSESSMENT
LANDFILL COMPONENT OF
SOLID WASTE MANAGEMENT

JUNE 1985

W

4.2 Conclusions of Individual Site Plan Area Pairings

A summary of the results of the site pairings are shown below (Table 6), with an underlined reference (_) to the "preferred site" of each pair.

TABLE 6

SUMMARY OF PAIRING RESULTS

AB -	BC*	CE
AC	BD	CF
AD	BE	DE
AE	BF	DF
AF	CD	EF

*Ranked as 5th and 6th from previous section.

Table 6 indicates the following:

A is preferred to B, and C.

B is preferred to no others.

C is preferred to no others.

D is preferred to A, B, C, and E.

E is preferred to B and C.

F is preferred to A, B, C, D, and E.

A final ranking can be established from the above results:

Rank	Site Plan Area
1	F
2	D
3	A and E
5	B
6	C

Based on this ranking the consulting team recommendation is that Site F be selected as the preferred site for landfill in Halton. It should also be noted that Site D, which is ranked second, has a number of positive attributes, which separate it more significantly from the lower-ranked Site Plan Areas A and E. Sites B and C do not warrant further consideration.

Based on this ranking the consulting team recommendation is that Site F be selected as the preferred site for landfill in Halton. It should also be noted that Site D, which is ranked second, has a number of more positive attributes, which separate it more significantly from the lower-ranked Site Plan Areas A and E. Sites B and C do not warrant further consideration.

THE INCORPORATION OF THE REASONABLE USE CONCEPT INTO THE GROUND WATER MANAGEMENT ACTIVITIES OF THE MINISTRY OF THE ENVIRONMENT

ONTARIO MINISTRY OF THE ENVIRONMENT
WATER RESOURCES BRANCH

SEPTEMBER 1986

Prepared by:

WATER MANAGEMENT STEERING COMMITTEE
WORKING GROUP V

POLICY TITLE	WATER MANAGEMENT - GOALS, POLICIES, OBJECTIVES AND IMPLEMENTATION PROCEDURES OF THE MINISTRY OF THE ENVIRONMENT (REVISED MAY 1984)	NO 15-01-01

Legislative Authority

Ontario Water Resources Act

Statement of Principles

To ensure the effective management of the Province's water resources, the following goals and policies contained in the publication Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment, November 1978 (Revised May 1984) shall be adhered to. Reference should be made to that publication for additional details of the guidelines, procedures and tables referred to in the following.

SURFACE WATER QUALITY MANAGEMENT

GOAL

TO ENSURE THAT THE SURFACE WATERS OF THE PROVINCE ARE OF A QUALITY WHICH IS SATISFACTORY FOR AQUATIC LIFE AND RECREATION.

Water which meets the water quality criteria for aquatic life and recreation (designated as the Provincial Water Quality Objectives, Table 1), will be suitable for most other beneficial uses, such as drinking water and agriculture. For the few parameters, where better water quality is required to protect these other beneficial uses in a given location, the appropriate criteria shall be applied in that location.

August 22, 1986

Point of Contact

Director,
Water Resources Branch

Effective Date

June 5 1986

POLICIES

1. Areas with Water Quality Better than the Objectives

In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives.

2. Areas with Water Quality Not Meeting the Objectives

Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives.

3. Effluent Requirements

Effluent requirement will be established on a case-by-case basis. In establishing effluent requirements, the characteristics of the receiving water body will be considered, as will Federal and Provincial effluent regulations and guidelines where applicable. The effluent requirements so derived will be incorporated into Certificates of Approval (under Section 24, Ontario Water Resources Act) and will specify both waste loadings and concentrations.

4. Hazardous Substances

Special preventive measures are required to deal with the release of known or potentially hazardous substances. Accordingly, the Ministry's policy is to:

i) prevent the release of those substances listed in Table 2 which are hazardous if released in any concentration:

ii) ensure that special measures are taken on a case-by-case basis to minimize the release of any substances for which Provincial Water Quality Objectives have not yet been established.

5. Mixing Zones

A mixing zone is defined as an area of water contiguous to a point source where the water quality does not comply with the Provincial Water Quality Objectives. Terms and conditions related to a mixing zone will be designated on a case-by-case basis and may be specified in Certificates of Approval, control orders, requirement and directions, or approvals to proceed under the Environmental Assessment Act. The size of the mixing zone shall be minimized to the greatest possible degree and under no circumstances is the mixing zone to be used as an alternative to treatment.

SURFACE WATER QUANTITY MANAGEMENT

GOAL

TO ENSURE A FAIR SHARING OF THE AVAILABLE SUPPLY OF WATER TO PROTECT BOTH WITHDRAWAL AND IN-PLACE USES OF WATER

POLICIES

1. Water Quality-Quantity Inter-relationships

The withdrawal of water from and discharge of water to surface water bodies will be controlled to assist in maintaining or restoring water quality for the protection of aquatic life and recreation.

2. Permits to Take Water

Surface water takings will be controlled to prevent interference with other uses of water wherever possible and to resolve such problems if they do occur.

3. Surface Water Conservation

All reasonable and practical measures should be taken to conserve the quantity of surface water in order to maximize its availability for existing or potential beneficial uses.

GROUND WATER QUALITY MANAGEMENT

GOAL

TO PROTECT THE QUALITY OF GROUND WATER FOR THE GREATEST NUMBER OF BENEFICIAL USES

In the majority of cases, human consumption will be the most important use of water to be protected, but there are other ground water uses such as agriculture with specific water quality requirements which will also be protected. Appropriate criteria for these two uses are given in Tables 4 and 5. In addition, protection of aquatic life (Table 1) is a consideration in cases where ground water is a significant component of streamflow.

POLICIES

1. Regulated* Sources of Contamination

The waste control requirements for proposed regulated waste discharges will be established on a case-by-case basis. As a general policy, water quality degradation will be controlled in order to protect reasonable uses, existing or proposed, of both ground and surface waters. The Ministry requirements relating to the quantity and the quality to the discharge will be specified and control measures may also be stipulated in the Certificate of Approval.

The treatment or elimination of pollutants from existing activities will be required where it is demonstrated that such measures are practicable and necessary to correct use impairment and will prevent further degradation or improve water quality. Where such measures are not practicable, the Ministry may require replacement of the affected supplies.

2. Unregulated** Sources of Contamination

All reasonable measures shall be undertaken to reduce or prevent the contamination of ground water by proposed or existing unregulated activities.

* Regulated refers to those activities which require specific approval under the Ontario Water Resources Act or the Environmental Portection Act.

** Unregulated refers to those activities which do not require specific approval under the Ontario Water Resources Act or the Environmental Protection Act.

GROUND WATER QUANTITY MANAGEMENT

GOAL

TO ENSURE THE FAIR SHARING AND CONSERVATION OF GROUND WATER

POLICIES

1. Permits to Take Water

Ground water takings will be controlled to prevent water supply interference wherever possible through a water taking permit program under Section 37 of the Ontario Water Resources Act.

2. Resolution of Interference Problems

In the event that a ground water taking authorized by permit interferes with another water supply obtained from any adequate source that was in use prior to the issuance of the permit, the party causing the interference shall restore the affected supply or reduce the taking to eliminate the interference.

3. Ground Water Conservation

All reasonable and practical measures shall be taken to promote the conservation of ground water.

POLICY TITLE	INCORPORATION OF THE REASONABLE USE CONCEPT INTO MOE GROUNDWATER MANAGEMENT ACTIVITIES	NO. 15-08-01

Legislative Authority

Ontario Water Resources Act, R.S.O. 1980

Statement of Principles

This policy establishes the basis for determining the reasonable use of groundwater on property adjacent to sources of contaminants and explains the role of a reasonable use approach in the Ministry's various activities related to groundwater quality.

The policy is designed to facilitate implementation of the groundwater quality management policies and procedures contained in the publication "Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment", which are based on protecting existing and potential reasonable uses of water. The reasonable use concept applies only to groundwater quality management.

The policy addresses the levels of contaminant discharges considered acceptable by the Ministry and the levels of contamination in water supplies which would warrant restoration of those water supplies.

Detailed information on the policy is contained in the document entitled "The Incorporation of the Reasonable Use Concept into the Groundwater Management Activities of the Ministry of the Environment", April 1986.

May 1, 1986

Point of Contact

Director, Water Resources Branch

Effective Date

April 25, 1986

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THE INCORPORATION OF THE REASONABLE USE CONCEPT INTO THE GROUND WATER MANAGEMENT ACTIVITIES OF THE MINISTRY OF THE ENVIRONMENT

1.0 PURPOSE AND OBJECTIVE

The basic purpose of this document is to establish procedures for the determination of what constitutes reasonable use of ground water on property adjacent to sources of contaminants and to explain the role of a reasonable use approach in the Ministry's various activities related to ground water quality. This is needed to facilitate implementation of the ground water quality management policies and procedures contained in "Water Management Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment," November 1978, Revised May 1984 (Water Management), which are based on protecting existing and potential, reasonable uses of water. The reasonable use concept applies only to ground water quality management. The Ministry's surface water quality management policies are presented in the booklet "Water Management". This document addresses the levels of contaminant discharges considered acceptable by the Ministry.

It is important to remember that this document identifies the Ministry's perception of the issues addressed and the solutions which the Ministry will employ or endorse. The Ministry can only insist on utilization of its own policies and guidelines when matters are under the Environmental Protection Act or the Ontario Water Resources Act, but its actions, even there, are usually subject to appeal. When the Environmental Assessment Act or the Consolidated Hearings Act

is utilized, the Ministry does not have the power to make decisions incorporating Ministry policies and perceptions; the decision-making power is elsewhere and the Ministry can only suggest and recommend.

In Section 2 the administrative and technical basis for adopting the Reasonable Use approach is outlined and discussed. In Section 3, terms are defined and the Reasonable Use concept is applied to the issuance of Certificates of Approval for the following Ministry-regulated activities; proposed landfills, operating landfills, landfills requesting approval for expansion, exfiltration lagoons and large sub-surface sewage systems. This document does not apply to the clean-up of contaminated ground water or to the restoration of ground water supplies that have been contaminated by "unregulated" sources of contamination such as closed landfills, and spills. These are addressed in Policy No 15-10, "Guidelines for the Resolution of Ground Water Quality Interference Problems".

2.0 ADMINISTRATIVE AND TECHNICAL BASIS FOR THE REASONABLE USE APPROACH

2.1 Ministry Policy

The Ministry's policy as presented in the November, 1978 publication "Water Management" referred to reasonable uses of ground water, to clearly indicate that the Ministry would require sufficient levels of environmental control to protect reasonable uses of the ground water.

Potential reasonable uses are also specified to indicate that the Ministry has concern not only for present but for future uses of ground waters in the Province. The policy is intended to assist in making decisions about current, and future activities of the Ministry. It is not intended that all waste disposal facilities be investigated immediately to

determine if they meet the levels for contaminant discharge described in this document.

2.2 Determination of Reasonable Use

The Ministry's decision as to what constitutes reasonable use and potential use of ground water on land associated with or adjacent to waste disposal sites will be made on a case-by-case basis. This is necessary because the wide variation in the quality, quantity and availability of ground water makes a fixed, standard approach impractical.

The responsibility for deciding what constitutes the reasonable use of the ground water and what uses should be protected will normally rest with the Regional Director. The Director will base his decision on input from a proponent and/or an assessment by his staff. If his decision becomes a major issue in a specific case, it could be made the subject of a public hearing.

Reasonable use and potential use must be established with respect to specific soil and water-bearing units in the subsurface and would apply to all of the ground lying beneath a particular property. As is discussed later in this Section, in most cases, the reasonable use of ground water will be for domestic consumption. However, when it can be demonstrated that there is some other reasonable use of ground water with different water quality requirements, then criteria appropriate to that use will be applied.

The decision as to the reasonable use of the ground water at a particular location shall be based on three major considerations:

a) the present use of the ground water,
b) its potential use, and
c) the amount and quality of the ground water that is available.

a) The present use of ground water in the vicinity. This is easily determined by a survey of the uses being made of the ground water by nearby land owners and from data in the Ministry's files. In most instances, the present use will be taken as the reasonable use.

b) Potential use of ground water in the vicinity. Where there is no current use of the ground water in the vicinity, criteria will be established on the basis of the potential use of that water. The judgement of potential reasonable use of the ground water will be based on the quality and quantity now present in the vicinity, and the current use of that particular resource in the general area. In addition, the work of planning agencies etc. may provide input to determine potential land use in the vicinity as this might affect the use of the ground waters.

c) The existing quality and quantity of the ground water in the vicinity. The existing quality of the ground water in the vicinity and the amount of that water which would be available to wells must be assessed. This can be accomplished by using data in the Ministry's files and a general knowledge of the hydrogeology in the area.

The potential use of ground water in Ontario will almost always be for domestic consumption. This is because:

a) There are virtually no parts of Ontario where the quantity of ground water that could be collected by a well will not meet the basic needs of a single family.

b) Although there are parts of Ontario where the quality of the ground water does not meet the Ontario Drinking Water Objectives, in most cases, individual owners have

used such waters on a continuing basis over many years (Section 3.4).

The presence of piped or surface water supplies is not necessarily justification for considering that there is no potential use for the ground water. However, it may be a contributing factor (Section 3.4) where other considerations, such as naturally poor quality, would detract from the usefulness of the ground water.

The desirable qualities of drinking water are specified in the document "Ontario Drinking Water Objectives". Water quality objectives for protection of fish and aquatic life and for agricultural use are stipulated in Tables 1 and 5 of "Water Management". Each publication contains, in addition to the numerical objectives, directions as to their application. In those instances where there is no Ministry of the Environment objective for a given parameter, the Regional Director may specify what is considered to be an appropriate objective based on current scientific evidence.

2.3 Other Land Uses

Related land uses which could be affected by contaminants transported by ground water, and which are compatible with a reasonable use approach, include: the use of the soil for agricultural activities, the use of the sub-surface for facilities such as sewers, electrical conduits or building foundations, or the use of the soil as fill.

2.4 General Technical Considerations

A number of general technical considerations have been taken into account in the development of this document.

A. The Ministry considers that the following positions represent good ground water management practice:

i) There are suitable environments in Ontario and adequate technology is available so that it is not necessary to degrade any subtantial ground water resource by waste disposal.

ii) Allocation of all of the attenuation capacity in a particular area to a single source of contaminants may not be prudent. This is because it may not be possible to prevent additional contaminant loadings in the future. This anticipated additional contaminant loading must be assessed on a case-by-case basis.

iii) Provision should be made, in the form of contingency plans, for alleviating unacceptable environmental impacts, in so much as possible, should this prove to be necessary in the future. Experience in the identification of previously unsuspected contaminants has shown that such a need should be anticipated.

B. It is not generally possible with present technology, to estimate accurately the quantity or the quality of contamination which will discharge from a waste disposal facility. Uncertainty factors on the order of at least five times are common in the measurement of parameters such as hydraulic conductivity. Therefore large safety margins should be incorporated into all estimates of contaminant discharge.

The safety margin that is appropriate would have to be assessed on a case-by-case basis depending on the complexity of the hydrogeologic environment, the degree of uncertainty in the assessment, and the consequences of failure of the system.

There is a higher level of certainty when an existing contaminant plume is present and can be used in an assessment than when no plume is present.

C. There are some practical differences in the hydrogeologic aspects of solid and liquid waste disposal facilities. These differences are associated with monitoring (the initiation and appearance of contaminant discharge) and contingency measures (the removal of the waste).

D. The use of land adjacent to a waste disposal facility, in addition to those uses associated with water supplies, can be affected by liquid or gaseous contaminants transported by the ground water or moving through the unsaturated zone in the subsurface. The protection of these uses is also the responsibility of the Ministry.

2.5 Environments Unsuitable for Waste Disposal

The Ministry may not support proposals for waste disposal facilities in the following environments:

1. Where no appreciable attenuation can be provided in the subsurface and an excessive amount of the attenuation required for acceptable discharge must be provided by dilution in surface waters.

2. Where only a relatively small amount of natural attenuation will be provided by the environment and an unusually large area is required for the attenuation of contaminants as compensation for that poor environment. For technical reasons, environments where this is necessary are generally quite expensive to evaluate and contingency plans in such environments are seldom practical.

3. Where the subsurface beneath the facility is particularly suited for a better use. For example, waste disposal may not be supported in an esker of sand and gravel where the esker might be needed at some future date for the development of a water supply.

4. Where the consequences of failure are unacceptable. For example, waste disposal may not be supported where failure or contaminant discharge might affect the sole source of a community water supply to an unacceptable degree.

3.0 THE APPLICATION OF THE REASONABLE USE APPROACH TO MINISTRY ACTIVITIES

3.1 Introduction

In this Section, the reasonable use concept is applied to:

(a) determining quantitatively the acceptable levels of various contaminants originating in Waste Disposal Sites and impinging on Adjacent Properties.

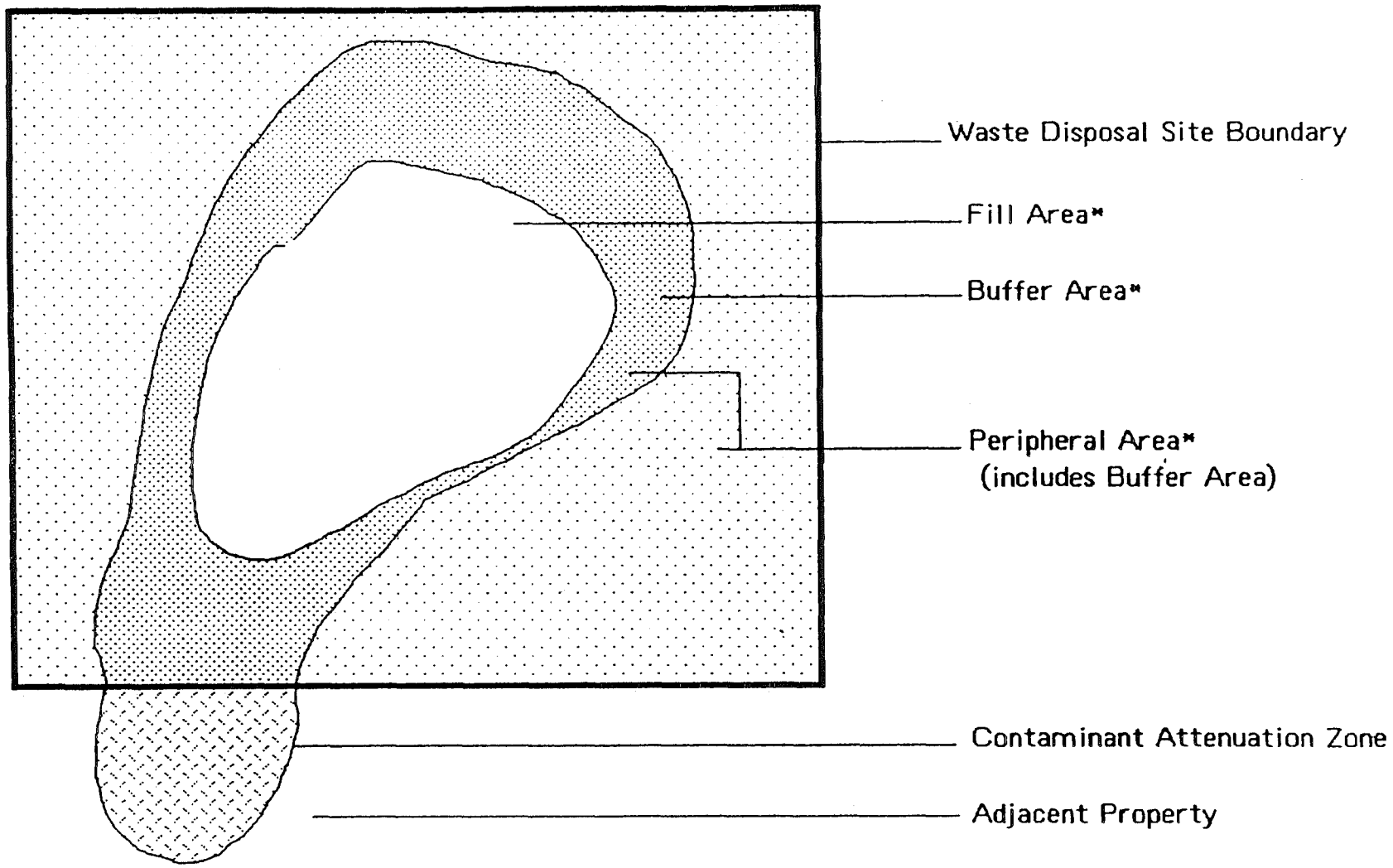
(b) assessing the suitability of a Contaminant Attenuation Zone, and a Waste Disposal Site.

Terms are specifically defined in Section 3.3 and are illustrated in an accompanying schematic diagram.

3.2 The Ministry of the Environment's Responsibility and Authority

The Ministry of the Environment is charged with the conservation of the ground water resources of the Province and the control of the use of these resources in an effective manner for the public good. To this end, the Ministry may wish to discourage the use of some environments for waste disposal and encourage the use of other environments. The

SOLID WASTE DISPOSAL SITE– SCHEMATIC VIEW



* See MOE document *Land Use and Waste Management Glossary* for definitions of terms

Ministry position is that Waste Disposal Sites should . placed in environments where their impact will be minimized, that acceptable disposal methods should be used and that these methods should be compatible with those particular environments.

For waste disposal activities the Ministry has the management authority to:

1) Issue a Certificate of Approval which would permit the use of property for contaminant attenuation or treatment. Discharge to neighbouring property must have no more than a negligible effect on the use of this property. The question of whether the effect is negligible, if challenged, could be established by the courts, which would decide if there is damage and how it can be measured in terms of dollars. This is inherent in the approach used by the Ministry in other situations, such as the issuance of air approvals.

2) Prevent the owner of a Waste Disposal Site from using the sub-surface beneath his property for waste disposal purposes if this use is not felt to be in the public interest.

This management authority is subject to the limitation and qualifications in Section 1.0.

3.3 Definition of Terms

For the purpose of this paper, the Ministry will consider three areas in assessing waste disposal proposals:

1. The Waste Disposal Site;
2. The Contaminant Attenuation Zone;
3. The Adjacent Property

These are illustrated in the accompanying diagram and ... in the following sections.

The terminology used in this discussion is adapted from the Ministry document titled "Land Use and Waste Management Glossary".

3.3.1 The Waste Disposal Site

For the general purposes of this Ministry, "Waste Disposal Site" is defined in Part 5 of the Environmental Protection Act to mean any land where waste is disposed or processed and includes any machinery, equipment or operations required for the treatment or disposal of the waste. Thus, a Part V Certificate of Approval for a Waste Disposal Site is issued for a parcel of land larger than the area where the waste will be deposited, as the adjoining land is necessary for proper site operations.

For the purposes of this paper, we are not considering Part V Waste Disposal Sites where treatment takes place, but only sites where disposal of the waste occurs. Also, for purposes of this paper, we will use the term Waste Disposal Site to include a large sub-surface sewage system or an exfiltration lagoon.

The most common Part V Waste Disposal Site at which disposal takes place is defined as a "Landfilling Site" in Regulation 309. The Waste Disposal Site comprises the area on or in which wastes are disposited, (the "Fill Area"), and any bordering land, (the "Peripheral Area"), as shown on the accompanying diagram.

Large sub-surface sewage disposal systems are described in Article 14.1 of the Manual of Policy, Procedures and Guidelines for Private Sewage Disposal Systems.

The following comments apply to a Waste Disposal Site:

a. Future use of the land should be strictly controlled. Based on technical considerations, such controls should be permanent or continued until it can be shown that such control is no longer necessary.

b. As there are environments which the Ministry does not believe are appropriate for waste disposal, the Ministry will either oppose the use of such environments or will insist that stringent safeguards be incorporated in any design for the Waste Disposal Site. These safeguards may include provision for the collection and treatment of any contaminants which will be produced. Guidelines for identifying environments unsuitable for waste disposal are presented in Section 2.5 of this document.

3.3.2 The Contaminant Attenuation Zone

The purpose of designating a "Contaminant Attenuation Zone" is to allow, in exceptional cases, the limited impairment of use of off-site property by means of easements or other methods without imposing the severe restrictions on land use which apply to the Waste Disposal Site.

Where appropriate, a Contaminant Attenuation Zone may be designated. It is outside of the Waste Disposal Site and it is defined both with respect to the area of land which it underlies and also with respect to the depth at which it lies.

In the Contaminant Attenuation Zone, it is intended that contaminants will be naturally attenuated to levels compatible with the reasonable use of the Adjacent Property as discussed in Section 2.2 and in order to meet the criteria

specified in Section 3.5.1.1. Contaminant levels in Contaminant Attenuation Zone may impair some uses of tha Zone. The operator of the Waste Disposal Site must obtain the right to the use of this Zone by reaching agreement with the property owner. The agreement should be registered on the title to this land.

Circumstances and environments favouring the designation of a Contaminant Attenuation Zone are discussed in Section 3.4.

3.3.3 The Adjacent Property

The Adjacent Property is the land bordering the Waste Disposal Site or the Contaminant Attenuation Zone. Discharge of contaminants (leachate) to Adjacent Property will have no more than a negligible effect on the present or potential reasonable use of that property. This will ensure that:

a) the presence of the contaminant will not interfere with the construction, installation or good operation of any usual facility in the subsurface, such as utility conduits;

b) the soil will not be contaminated to a degree which would interfere with its use;

c) the ground water will not be contaminated to a degree which would impair its use, where:

   (i) it is presently of acceptable quality;
   (ii) it is in a location from which it could be practically obtained;
   (iii) there is a potential use of the ground water for other purposes.

3.4 Circumstances and Environments Considered Suitable for a Contaminant Attenuation Zone

The Ministry may support an application for a Waste Disposal Site involving the acquisition of land or an easement for a Contaminant Attenuation Zone only under the following circumstances:

1. Where an alternate source of water is far superior to any associated with a Contaminant Attenuation Zone. Here the Ministry may support the use of the ground water for dilution and attenuation in a Contaminant Attenuation Zone and take the position that the effect on reasonable uses on Adjacent Property would be negligible because that ground water would not need to be used in any case.

   This circumstance could arise as follows:

   a. Where two water-bearing units are present, one being far superior to the other with respect to the quality, quantity and the accessibility of the water contained in it, the Ministry may accept the inferior unit as a Contaminant Attenuation Zone, provided that this will not interfere with the use of the superior unit.

   b. Where good supplies of water are available, either from surface water sources or from municipal systems, and the ground water supplies in a particular unit are marginal with respect to their quality and/or their quantity, the Ministry may support the use of that ground water as a Contaminant Attenuation Zone.

2) Where only an acceptably small, clearly defined and hydrogeologically restricted portion of a subsurface unit will be degraded and this subsurface unit is not likely to be required for a higher use.

This procedure would allow the Ministry to support the use of certain Crown Lands in Northern Ontario or well defined zones of ground water flow such as may be present in flood plains, as Contaminant Attenuation Zones despite their physical ability to yield ground water in "useful" quantities.

3) Under special circumstances and on a case-by-case basis where naturally high levels of iron, manganese and/or total dissolved solids (where these are associated with hardness) are present in the ground water and as a result, the limits imposed in Section 3.5.1.1 can not be met (see situations described in Section 3.5.1.2, Examples 2 and 3). This is because:

   a) Unlike the case in surface waters, concentrations of iron, manganese and total dissolved solids commonly in excess of the Provincial Drinking Water Objectives are naturally present in Ontario's ground waters. These ground waters are routinely used for domestic supplies.

   b) These parameters are not related to health, at the levels stated in the Provincial Drinking Water Objectives, and in addition can be removed from a water supply with commonly available techniques.

It is not practical to eliminate landfilling in a large percentage of the Province because of the natural presence of iron, manganese and total dissolved solids in excess of the Provincial Drinking Water Objectives.

4. Where, in exceptional cases in the judgement of the Regional Director, the most appropriate use of that environment would be as a Contaminant Attenuation Zone, although it is suitable for other purposes as well.

3.5 Landfills

3.5.1 The Assessment of Proposed Landfills.

3.5.1.1 Basic Approach - In accordance with the appropriate criteria for particular reasonable uses, such as those specified in "Water Management", a change in quality of the ground waters on the Adjacent Property will be acceptable only as follows:

> Quality cannot be degraded by an amount in excess of 50% of the difference between background and the quality criteria for any designated reasonable use except drinking water. In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Provincial Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Provincial Drinking Water Objectives for health-related parameters. Background is considered to be quality of the ground water prior to any man made contamination.

In accordance with Section 3.2 it is the Ministry's judgement that such increases in contaminant levels will have no more than a negligible effect on the use of the Adjacent Property.

In assessing the amount of degradation that is acceptable, consideration is given to the natural, uncontaminated quality of the ground water, the present quality of the ground water and potential contamination of the ground water from all sources.

3.5.1.2 Examples of the Application of the Concept - Below are given examples of the application of this concept to three different situations:

Example 1 - Where the designated reasonable use of ground water allows no change in quality, no change is acceptable.

Example 2 - Where the designated reasonable use of the ground water is drinking water and the ground water quality is presently better than the Provincial Drinking Water Objectives, a lowering of water quality on the Adjacent Property will be acceptable in accordance with the formula stated above. (See Section 3.4, Part 3. for possible exception)

Example 3 - Where ground water quality is currently poorer than the Provincial Drinking Water Objectives, but the ground water is nonetheless in use as a drinking water source, then no decrease in water quality will be acceptable. (See Section 3.4, Part 3 for possible exception).

3.5.1.3 Examples of the Calculations - Two calculations are required to determine the amount of contamination that can discharge from a Waste Disposal Site onto the Adjacent Property. The first calculation addresses the total contaminant impact at that location from all sources of contamination. The second addresses the permissible impact from the particular Waste Disposal Site.

The maximum concentration (Cm) of a particular contaminant that would be acceptable (Section 3.2) in the ground water beneath the Adjacent Property is calculated in accordance with the following relationship:

$$Cm = Cb + x(Cr-Cb)$$

The terms are defined as follows:

Cb - This is the background concentration of the particular contaminant in the ground water before it has been affected by man

(Section 3.5.1.1). This allows consideration to be given to the amount of increase in contaminant level.

Cr - This is the maximum concentration of the particular contaminant that should, in accordance with the Province's water management policy be present in the ground water. This value is dependent on the use (Reasonable Use) to be made of that ground water (Section 2.2). It allows consideration of the total amount of contamination.

x - This is a constant that reduces the contamination to a level that is considered by the Ministry to have only a negligible effect on the use of the water. For drinking water is 0.5 for non-health related parameters or 0.25 for health related parameters. For other reasonable uses it is 0.5. (Section 3.5.1.1).

Levels of contamination greater than Cm may have an appreciable effect on the use of the Adjacent Property and the Ministry will not support an application for a Certificate of Approval for Waste Disposal Site with contaminant discharges which would cause this level to be exceeded.

The maximum concentration of a particular contaminant (Cw) originating in the Waste Disposal Site that can be permitted to reach the Adjacent Property and still not cause Cm to be exceeded can be calculated in accordance with the following relationship:

$$Cw = Cm - Cp - Co$$

The terms are defined as follows:

Cp - This is the concentration of the particular contaminant in the ground water at the time of assessment, (i.e. the present background). This water may already contain some contaminants (Section 3.5.1.1). These contaminant levels must be subtracted to determine the contaminant increment that can be permitted from the Waste-Disposal Site.

Co - This is the potential contaminant increase from other sources with a high degree of probability (Section 2.4, Part A, ii). For example potential chloride contamination from a highway under construction next to the site must be subtracted to determine Cw.

Using chloride as an example, the maximum allowed chloride level (Cm) in the ground water beneath the Adjacent Property and the maximum chloride discharge (Cw) to the Adjacent Property from a hypothetical Waste Disposal Site are calculated as follows:

a) The reasonable use of the ground water beneath the Adjacent Property has been determined to be for domestic supplies.

b) The Ontario Drinking Water Objective for chloride (Water Management, P.52) is 250 mg/L. This represents Cr.

c) The natural uncontaminated background concentration of chloride is estimated to have been 10 mg/L. This represents Cb.

d) The measured concentration of chloride at the of the assessment is 40 mg/L. This represents Cp.

e) The expected additional chloride increase from a nearby highway that is presently under construction is estimated to be 20 mg/L. This represents Co.

f) Chloride is considered to be a non-health-related parameter and therefore the constant (x) is 0.5.

The maximum allowed concentration (Cm) of chloride beneath the Adjacent Property, in accordance with the relationship Cm = Cb + x (Cr-Cb) is therefore:

10 + 0.5 (250-10) = 130 mg/L

The maximum concentration of chloride (Cw) from the Waste Disposal Site that can be permitted to reach the Adjacent Property, in accordance with the relationship Cw = Cm - Cp - Co is therefore:

130 - 40 - 20 = 70 mg/L

It should be noted that the chloride ion will seldom be the critical contaminant parameter (i.e. the contaminant parameter which will most closely approach its maximum allowed value, Cm, and thus represent the limit to which the site is designed). However it is commonly used in contaminant investigations because of its usefulness as a "tracer". The critical contaminant is dependent on the characteristics of the wastes and the hydrogeologic environment and is determined on a case-by-case basis.

3.5.1.4 Site Assessment - The assessment of the proposed Waste Disposal Site should be carried out in accordance with any pertinent Ministry guidelines. In addition, Section 2.4 of this document "General Technical Considerations" should be

considered and in particular those parts relating to the provision of a safety margin in making estimates of contaminant discharges. (Part B.)

3.5.2 The Assessment of Operating Landfills

An Operating landfill is handled as follows:

a) An operating landfill should meet the same limits for contaminant discharge (Section 3.5.1.1) as a proposed landfill.

b) The judgement as to the amount of offsite impact that the landfill will produce may be based on actual offsite measurements of contaminant levels or on predictions of offsite contaminant levels which are based on onsite measurements. This reduces the requirements for a safety margin in calculations (Section 2.4, Part B).

c) If contaminant concentrations exceed the limits specified in Section 3.5.1.1 but are less than 100% of the particular water quality criteria, the landfill should be closed in a manner to minimize environmental damage, or the operation should be modified. It is acceptable to modify the landfill operation, for example, by installing a cover with low hydraulic conductivity, in order to meet the specified limits. However if these levels are exceeded, it may be prudent to require all landfilling, except that done in conjunction with closure or remedial activities, be terminated until the specified limits have been
met, or until monitoring data indicate that these limits will be met.

d) If contaminant discharge exceeds 100% of the particular water quality criteria and modifications in the design in accordance with c, above cannot be accomplished, the landfill should be closed. Determinations on the

replacement of contaminated water supplies and the abatement of the contaminant plume must be made on a case-by-case basis.

3.5.3. The Assessment of Landfills Requesting Certificates of Approval for Expansion.

A Certificate of Approval for a landfill requesting expansion will be handled in the same manner as would the Certificate of Approval for a new landfill or proposed landfill (i.e. it must meet the limits specified for contaminant discharge in Section 3.5.1.1).

3.6 Exfiltration Lagoons and Large Subsurface Sewage Disposal Systems

Exfiltration lagoons and large subsurface sewage disposal systems must meet the same criteria for operation and closure as landfills. (Section 3.3.1.1)

REASON/USE.2

BEFORE THE JOINT BOARD

IN THE MATTER OF The Regional Municipality of Halton's Landfill Environmental Assessment

WITNESS STATEMENT

OF

GEORGE M. HUGHES

Supervisor

Landfill Disposal Technology Unit

Waste Management Branch

Ministry of the Environment

June , 1988

Witness Statement of George M. Huges

I. Qualifications

1. My Curriculum Vitae is attached as Appendix "A" to this Witness Statement.

II. Involvement With Halton Landfill E.A.

2. With the exception of brief discussions pertaining to the interpretation of Ministry policy and guidelines and occasional technical advice, I have had no involvement with the Halton Landfill Environmental Assessment. I have not reviewed any of the documents in evidence before the Joint Board.

3. I am not sufficiently knowledgeable about either Sites D or F to comment on their hydrogeologic suitability for sanitary landfilling. I am in a position to explain two Ministry policies which are applicable to the consideration of the hydrogeologic suitability of the two sites.

III. Reasonable Use Policy

4. Ministry Policy 15 - 08, the "Incorporation of the

Reasonable Use Concept into MOE Groundwater Management Activities", is before the Joint Board as Exhibit E - 154.

5. Policy 15 - 08 explains and clarifies a statement in Policy 15 - 01, "Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment", which is also found at page 27 of the Ministry's "Blue Book". The statement is as follows:

> "Degradation of ground water quality will be controlled to protect both existing and potential, reasonable uses of water on adjacent property."

6. Included with Exhibit E - 154 is a guideline document that is referred to in Policy 15 - 08. The guideline document describes the methods the Ministry uses to,

> a) define the reasonable uses of ground water, and
>
> b) determine the levels to which ground water degradation will be controlled to achieve protection of those reasonable uses.

7. When the Ministry has the jurisdiction to deal with the approval of a landfill site under Part V of the Environmental Protection Act, the responsibility for making a determination on what constitutes the reasonable use of ground water would normally rest with the Regional Director. When the jurisdiction is with the Environmental Assessment Board or a Joint Board, the responsibility rests with the Board.

8. A determination as to what constitutes reasonable use is case specific and is based on the present use of the ground water, the future potential use of the ground water and the amount and quality of ground water available for use. In most cases, the potential reasonable use of ground water in Ontario will be domestic consumption.

9. I am informed that certain witnesses before the Joint Board have stated that the only reasonable use of ground water downgradient of site F is leachate attenuation. In my opinion, such a determination is possible within the confines of the policy and guideline, although I am unable to give an opinion on whether such a determination is appropriate in this case.

10. The basic approach to the determination of what level of degradation is acceptable is set out at page 16 of the guideline document as follows:

> "Quality cannot be degraded by an amount in excess of 50% of the difference between background and the quality criteria for any designated reasonable use except drinking water. In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Provincial Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Provincial Drinking Water Objectives for health-related parameters. Background is considered to be quality of the ground water prior to any man made contamination."

It is the policy of the Ministry of the Environment that such increases in levels of contamination at the site boundary will have no more than a negligible impact on the use of ground water on property adjacent to a landfill site.

11. Provincial objectives for drinking water are set out in the Ministry publication Ontario Drinking Water Objectives, which is popularly referred to as the "Green Book". Where Ontario Criteria have not been developed, (eg. for most organic chemicals), it is appropriate to use criteria developed in other jurisdictions or by the World Health Organization.

12. When it is predicted that boundary criteria established using the above formula will be exceeded, it is acceptable to the Ministry, in exceptional cases, to permit the limited impairment of ground water off-site through the designation of a "Contaminant Attenuation Zone". Circumstances considered suitable for such a designation are set out at pages 14 and 15 of the guideline document included with Exhibit E - 154.

IV. Engineered Facilities Policy

13. Ministry Policy 14 - 15, "Engineered Facilities at Landfills that Received Municipal and Non - Hazardous Wastes", was recently approved by the Minister and is now official Ministry policy. The policy and accompanying guideline document is attached as Appendix "B" to this Witness Statement.

14. The "Ministry Interim Guideline on Engineered Facilities at Landfills" dated July 13, 1987 is currently before the Joint Board as Exhibit N - 475. Policy 14 - 15 and the accompanying guideline replace that document.

15. The essence of the Engineered Facilities Policy is that an applicant seeking approval for a landfill must address in the application,

a) the engineered facilities that are to be used at the site,

b) the length of time over which those facilities are required, and

c) how maintenance or replacement of those facilities will be provided for, if necessary.

An applicant should demonstrate that engineered facilities can function for as long as they are needed.

16. The policy and guideline apply to all engineered facilities associated with the control of contaminants produced by landfills including liners, leachate collection systems, covers, gas collection, interception and venting facilities, monitoring facilities, leachate treatment facilities, facilities for the control of contaminated ground water and facilities for "stabilizing" a landfill.

George M. Hughes

CURRICULUM VITAE

SCHEDULE "A"

GEORGE M. HUGHES,
#9-65 INVERLOCHY BLVD.
THORNHILL, ONTARIO
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TELEPHONE NO. (416) 889-6072
BORN: SYDNEY, NOVA SCOTIA, AUGUST 14, 1929, CANADIAN CITIZEN.

EDUCATION

Ph.D., University of Illinois, Urbana, Illinois, 1962, Department of Geology. Thesis - The Glacial Geology of the Redwater and Morinville Areas, Alberta, Canada.

M.Sc., University of Alberta, Edmonton, 1959. Thesis - Study of Pleistocene Lake Edmonton and Associated Deposits.

Graduate Studies, University of Alberta, Edmonton, 1951-1952.

B.Sc., University of Alberta, Edmonton; Faculty of Arts and Science, Dept. of Geology, 1951.

EMPLOYMENT

SEPTEMBER 1983 - PRESENT	Supervisor, Landfill Disposal Technology Unit, Waste Management Branch, Ontario Ministry of the Environment, Toronto, Ontario.
NOVEMBER 1974 - SEPTEMBER 1983	Chief, Ground Water Protection, Water Resources Branch, Ontario Ministry of the Environment, Toronto, Ontario.
SEPTEMBER 1970 - NOVEMBER 1974	In charge of Northeastern Illinois Office of Illinois Geological Survey, Warrenville, Illinois.
1968 - SEPTEMBER 1970	Associate Geologist, Illinois State Geological Survey, Naperville, Illinois.
SPRING 1963 - 1968	Assistant Geologist, Illinois State Geological Survey, Naperville, Illinois.
SPRING 1962 - 1963	Assistant Geologist, Illinois State Geological Survey, Urbana, Illinois.
ACADEMIC YEARS - 1959, 1960, 1961	Half-time teaching assistant, Department of Geology, University of Illinois, Urbana, Illinois.
SUMMER 1958, 1959, 1960	Surficial mapping for the Research Council of Alberta in the Edmonton Area of Alberta.
MAY 1957 - SEPTEMBER 1957	Geologist - R. Adair Oil Management, Calgary, Alberta. Wellsite work in Western Canada.
MAY 1, 1952 APRIL 30, 1957	Geologist - Pan American Petroleum Corporation. Subsurface mapping and wellsite work in Western Canada.

MEMBERSHIP IN ORGANIZATIONS

National Water Well Association
The Society of the Sigma Xi
International Association of Hydrogeologists
Association of Professional Engineers of Ontario
American Institute of Hydrogeology

PUBLICATIONS

Bayrock, L.A. and G.M. Hughes, 1962, Surficial geology of the Edmonton District, Alberta: Alberta Research Council, Prelim. Report 62-6,40p.

Hackett, J.E. and G.M. Hughes, 1965, Controlled drilling program in Northeastern Illinois: Illinois Geological Survey Environmental Geology Notes, no. 1, 18 p.

Hughes, G.M., P. Kraatz and R.A. Landon, 1966, Bedrock aquifers of Northeastern Illinois: Illinois Geological Survey, Circ. 406, 15p.

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Farvolden, R.N., G.M. Hughes and R.A. Landon, 1967: Garbage and groundwater: Proc. Annual Meeting, Geological Association of Canada, Queens's University, Kingston, September 1967.

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Farvolden, R.N. and G.M. Hughes, 1969, Hydrogeologic factors in landfill design: Proceedings of the 16th Ontario Industrial Waste Conference, Niagara Falls, June 15-18, 1969, 8 p.

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PUBLICATIONS CONT'D

Hughes, G.M., R.A. Landon and R.N. Farvolden, 1971, Summary of findings on solid waste disposal sites in Northeastern Illinois: Illinois Geological Survey Environmental Geology Notes, no.45, 25p.

Hughes, G., J.J. Tremblay, H. Anger and J. D'Cruz, 1971, Pollution of groundwater due to municipal dumps: Inland Waters Branch Department of Energy, Mines and Resources, Ottawa, Canada Technical Bulletin No. 42, 98p.

Farvolden, R.N., and G.M. Hughes, 1971, Hydrogeological implications in solid waste disposal: Groundwater Pollution Symposium; Proc. of the Moscow Symposium, Russia, August 1971, p.146-158.

Hughes, G.M., 1972, Hydrogeologic considerations in the siting and design of landfills: Illinois State Geological Survey, Environmental Geology Notes, no. 51, 22p.

Hughes, G.M. and K. Cartwright, 1972, Scientific and Administrative criteria for shallow waste disposal: Civil Engineering, March 1972, p. 70-73.

Hughes, G., 1973, Hydrogeology and geomorphology as factors in waste management: Proc. International Conference on Land for Waste Management, Ottawa, Oct. 1973, Canadian Society of Soil Science, p.119-125.

Terry, R.D. and G.M. Hughes, 1976, Pollution effects on Surface waters and ground waters: Journal Water Pollution Control Federation, vol. 48, no. 6., p.1420-1433.

Griffin, R.A. et al, 1976, Attenuation of pollutants in municipal landfill leachate by clay minerals: Part 1, Column leaching and field verification: Illinois State Geological Survey, Environmental Geology Notes, no. 78, 34p.

Griffin, R.A., N.F. Shimp, J.D. Steel, R.R. Ruch, W.A. White and G M. Hughes, 1976, Attenuation of pollutants in municipal landfill leachate by passage through clay: Environmental Science and Technology, vol. 10, no. 13., p.1262-1268.

Hughes, G.M., J.A. Schleicher and K. Cartwright, 1976 Supplement to the final report on the hydrogeology of solid waste disposal sites in Northeastern Illinois: Illinois State Geological Survey, Environmental Geology Notes, no. 80, November 1976.

Panel on Land Burial, National Research Council, 1976, The shallow land burial of low-level radioactively contaminated solid waste: Panel on Land Burial, National Academy of Sciences, Washington, D.C., 150 p.

PUBLICATIONS CONT'D

Hughes, G.M., 1977, Groundwater contamination and its control. Proceedings of the 24th Ontario Industrial Waste Conference, Ontario Ministry of the Environment, p.224-256.

Hughes, G.M., 1977, Some hydrogeologic considerations in landfill site evaluation: Internal report, Ontario Ministry of the Environment, 26p.

Cartwright, K., C.S. Hunt, G.M. Hughes and R.D. Brower, 1979, Hydraulic potential in Lake Michigan bottom sediments: Journal of Hydrology, v. 43 (1979) p.67-78.

POLICY TITLE	ENGINEERED FACILITIES AT LANDFILLS THAT RECEIVE MUNICIPAL AND NON-HAZARDOUS WASTES	NO. 14-15-01

Legislative Authority

The Environmental Protection Act

Statement of Principles

In order to protect the environment and human health, the Ministry will review and evaluate applications for new landfills and landfill expansions in accordance with the following position statement:

An engineered facility must function as long as necessary for the protection of the environment.

If periodic or continuous maintenance or replacement is required, evidence must be provided by the applicant that this can and will be accomplished.

This policy is written in accordance with the Ministry's current policy 15-08 entitled "The Incorporation of the Reasonable Use Concept into the Ground Water Management Activities of the Ministry of the Environment".

Definitions

Contaminating Life Span	It is defined as the period of time during which the landfill will produce contaminants at levels that could have unacceptable impact if they were discharged into the surrounding environment.

Point of Contact

Director, Waste Management Branch

Effective Date

May 11, 1988

1.0	Scope	This policy applies to applicants for new or expanded landfill sites which receive municipal and non-hazardous wastes and to Ministry staff responsible for the review and evaluation of such proposals.
2.0	MOE Responsibility	The Ministry will review and evaluate all applications for new and expanded landfill sites in accordance with the covering statement of principles and the Ministry's governing Guideline document (noted below).
3.0	Applicant's Responsibility	The applicant will be responsible for providing Ministry staff with sufficient evidence to adequately review and evaluate his/her proposal.
	3.1 Service Life	It is the applicant's responsibility to define the service life of an engineered facility and indicate the frequency of replacement and the number of times it must be replaced.
	3.2 Contaminating Life Span	In doing so, the applicant must address the contaminating life span of the landfill, equate this with the proposed service life of the engineered facility and support any procedures he/she intends to use ensure that the service life of the facility exceeds the contaminating life span of the landfill.
4.0	Further Guidance	Further guidance with respect to the use of landfill liners, leachate collection and treatment facilities, landfill covers and rapid stabilization and leachate recycling is provided in the Ministry's "Guideline on Engineered Facilities at Landfills that Receive Municipal and Non-Hazardous Wastes" dated March 1988.

Copies of the above noted document can be obtained from the Ministry's Waste Management Branch

MINISTRY GUIDELINE

FOR ENGINEERED FACILITIES AT LANDFILLS

THAT RECEIVE MUNICIPAL AND NON HAZARDOUS WASTE

(APRIL 20, 1988)

This document addresses engineered facilities at sites receiving municipal and non hazardous wastes. Engineered facilities at sites receiving hazardous wastes, as defined by Regulation 309, will be dealt with on a case-by-case basis.

Some level of engineering is necessary for all modern landfills both for the protection of the environment from the discharge of unacceptable levels of liquid and gaseous contaminants, and for aesthetic reasons. The specific engineered facilities that are required on a particular landfill depend on the environmental conditions that are present and the type of waste, and thus can only be judged on a case-by-case basis. In some cases, this may entail only simple ditching or grading for the control of surface run off, in others complex leachate and gas control facilities may be required. (The scope of the term "engineered facility" is discussed at the end of this document).

The Ministry's "Reasonable Use" Policy (MOE Policy 15-08: The Incorporation of the Reasonable Use Concept into the Ground Water Management Activities of the Ministry of the Environment), sets limits to the level of ground-water contamination and applies to discharges from landfills. Landfills, including those with engineered facilities, must meet the requirements of this Policy.

POSITION STATEMENT

It is the Ministry's position that there are limitations to engineered facilities and it prefers sites in environments with characteristics that provide a high degree of natural protection (e.g. thick clay deposits.)

The acceptability of an engineered facility for a new landfill or a landfill that is expanding will be judged in accordance with the following:

> "AN ENGINEERED FACILITY MUST FUNCTION AS LONG AS NECESSARY FOR THE PROTECTION OF THE ENVIRONMENT. IF PERIODIC OR CONTINUOUS MAINTENANCE OR REPLACEMENT OF AN ENGINEERED FACILITY OR ITS PARTS IS REQUIRED, EVIDENCE MUST BE PROVIDED BY THE APPLICANT THAT THIS CAN AND WILL BE ACCOMPLISHED. IT IS THE APPLICANT'S RESPONSIBILITY TO DEFINE THE SERVICE LIFE OF AN ENGINEERED FACILITY AND INDICATE THE FREQUENCY OF REPLACEMENT AND THE NUMBER OF

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TIMES IT MUST BE REPLACED. IN SO DOING, THE APPLICANT MUST ADDRESS THE CONTAMINATING LIFESPAN' (i.e. THE TIME PERIOD DURING WHICH THE LANDFILL WILL PRODUCE CONTAMINANTS AT LEVELS THAT COULD HAVE AN UNACCEPTABLE IMPACT IF THEY WERE TO BE DISCHARGED INTO THE SURROUNDING ENVIRONMENT) OF THE LANDFILL, EQUATE THIS WITH THE SERVICE LIFE OF THE PROPOSED ENGINEERED FACILITY, AND SUPPORT ANY PROCEDURES HE INTENDS TO USE TO ENSURE THAT THE SERVICE LIFE OF THE FACILITY EXCEEDS THE CONTAMINATING LIFESPAN OF THE LANDFILL". THE MINISTRY WILL REVIEW AND EVALUATE THE APPLICANT'S PROPOSAL.

Engineered facilities (or combinations of facilities) will meet the following requirements:

1. It must be possible to monitor the engineered facility to verify that it performs to specification. Monitoring must be able to warn of failure sufficiently in advance to allow contingency measures to be taken. Contingency measures are designed to accommodate any failure in the design of a landfill and are not a part of the normal operation during the life of the facility.

2. The contaminating lifespan of the landfill must be addressed in the contexts of the service lives of the various engineered facilities that are used to control contamination.

3. Provision must be made for the maintenance of an engineered facility and its operation for as long as is required under the Position Statement. A detailed outline of how funding will be provided, who will bear the short-term and ultimate responsibility for the facility, the length of time that the facility will be operating, and recommendations as to the conditions under which the facility can be closed down or no longer monitored or maintained must be provided in an application.

4. Manuals on the design of various types of engineered contaminant control facilities, such as covers and liners, are available. However, some of these are very specialized and are new technologies. Under these circumstances the Ministry will require technical supporting data on the performance of these systems.

5. If an applicant cannot specify the time period for the decommissioning of an engineered facility the Ministry will consider that the facility will be required indefinitely and provisions for its perpetual care, maintenance and replacement must be provided. This is the responsibility of the applicant.

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The Ministry will apply this Guideline to specific types of engineered facilities as discussed in the following pages. Other types of engineered facilities will be addressed if the need arises.

LANDFILL LINERS

Synthetic Membrane Liners: To function properly, a synthetic membrane liner must retain its integrity (i.e. function as designed) for the contaminating lifespan of the landfill. The state-of-the-art does not allow precise determination of rates of attenuation or degradation of leachate in lined landfills. Therefore, in the absence of data or site-specific information to the contrary, where complete attenuation of the contaminants in the leachate is necessary, the Ministry will require that the containment facilities be maintained in perpetuity. At the present time, synthetic membrane liners cannot meet this requirement and in addition they cannot be replaced when they fail.

The Ministry is also concerned about the difficulty in providing monitoring systems for landfills with synthetic membrane liners. Such systems must have appropriately long service lives and provide sufficiently early warning of failure to allow effective contingency actions, should these be necessary.

For these reasons, the Ministry will not support proposals that depend upon synthetic membrane liners to confine leachate in landfills in perpetuity.

Earth and Clay Liners: Earth and clay liners may serve to reduce leachate discharge and confine leachate for collection and to attenuate some of the contaminants in leachate migrating out of a landfill. They may be used alone or in conjunction with synthetic membrane or other types of liners. Applicants proposing to use earth or clay liners should address these matters in their submissions to the Ministry.

LEACHATE COLLECTION FACILITIES AND LEACHATE TREATMENT FACILITIES

To serve effectively leachate collection facilities and leachate treatment facilities must function for the contaminating lifespan of the landfill. The state-of-the-art does not allow precise determination of rates of attentuation or degradation of leachate within landfills. Therefore in the absence of data or site specific information to the contrary, where the complete attenuation of the contaminants in the leachate is necessary, the Ministry will require that these collection facilities and treatment facilities be maintained in perpetuity.

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Leachate collection facilities and leachate treatment facilities must be designed, constructed, operated and monitored by professional staff and require competent technical staff for their continued maintenance, repair and replacement. Where approved, the Ministry will require that adequate resources be dedicated to the maintenance of any leachate collection, treatment, transporting and disposal facilities for as long as the leachate remains a potential hazard to the environment.

LANDFILL COVERS

Synthetic Membrane Covers: Synthetic membrane covers are used to prevent or significantly decrease infiltration into a landfill in order to reduce the rate of leachate production. This reduction of infiltration retards decomposition and extends the contaminating lifespan of a landfill. Consequently, this type of cover is not encouraged by the Ministry in situations where it would delay stabilization of the wastes. An applicant proposing such a cover must establish the contaminating lifespan of the landfill and provide for maintenance and periodic replacement of the cover as long as required. In the absence of evidence to the contrary, this will be considered to be in perpetuity.

Synthetic membrane covers will impede the upward venting of gases, and in particular methane, and in so doing may increase the distance these gases migrate laterally. These concerns should also be addressed in submissions to the Ministry.

"Clay" Covers: Clay covers (covers incorporating fine textured earth materials) are also intended to reduce infiltration into landfills. Such covers require maintenance to ensure proper growth of vegetation and to prevent failure by erosion and fissuring. Resources for these maintenance activities should be identified by an applicant.

RAPID STABILIZATION AND LEACHATE RECYCLING

Rapid stabilization of a landfill is a process intended to accelerate the biodegradation of the waste and reduce the time period during which settlement is most rapid and the landfill produces its most highly contaminating leachate. Although the technology has been known for 15 to 20 years, and has been used in some operating landfills there is little documented information from practical successful operations.

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While rapid stabilization will accelerate the biological degradation and leaching of a landfill it does not create a contaminant-free waste. A "stabilized" landfill still produces methane and a contaminating leachate.

Leachate recycling, entails pumping the leachate produced from a landfill, back into the landfill. This is the basis for most rapid stabilization operations but is also used as a means of delaying the handling and disposal of leachate by temporarily storing this leachate in the landfill. In most instances this will be a short-term measure and leachate, will eventually accumulate to a volume that exceeds the storage capacity of the landfill. Disposal must then be made in a manner acceptable to the Ministry.

The Ministry is also concerned that leachate recycling will create added head on the base of the landfill and this will cause an increase in the amount of leachate discharge to the surrounding soils. These matters should be addressed by an applicant.

An important aspect of this Guideline is the requirement that, if the contaminating lifespan of the landfill is not addressed in an applicant's submission, the Ministry will assume that certain engineered facilities must function in perpetuity. Rapid stabilization of the landfill is the only known method of shortening this contaminating lifespan so that contaminants released to the environment can be attenuated by natural processes. In light of the shortage of practical field data on this process, submissions should be conservative and supported by practical contingency measures in the event that stabilization is not as effective as predicted.

CONCLUDING STATEMENT

It is recognized that this Guideline will restrict the use of engineered facilities as a means of landfilling in sensitive hydrogeologic environments. It is felt, however, that the level of control required by this Guideline is necessary to protect Ontario's clean environment and valuable ground and surface water resources. Where some reasonable level of natural protection is present or where practical contingency measures are possible, the Ministry will actively consider an applicant's proposal for engineered facilities so that new technology can be field tested and proven.

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SCOPE OF THE TERM ENGINEERED FACILITY

This guideline applies to all engineered facilities associated with the control of contaminants produced from landfills that receive municipal and non-hazardous wastes. This includes the design, installation and maintenance of:

a) Liners, or combinations of liners beneath landfills (plastic, membrane, earth, clay, etc.)

b) Landfill covers, (plastic, membrane, earth, clay, etc.)

c) Leachate collection facilities (drains, tiles, ditches, etc.)

d) Gas collection, interception and venting facilities.

e) Monitoring facilities (for ground and surface waters and for gas)

f) Leachate treatment facilities

g) Facilities for the control of contaminated ground water (purge wells, grout curtains, etc.)

h) Facilities for "stabilizing" a landfill or decreasing the time during which the landfill produces contaminants.

This Guideline applies to the assessment of new landfills or landfills requiring expansion. Although some of the principles on which the Guideline is based are applicable to closed landfills or landfills requiring remedial measures for contaminant control, the Guideline itself is not intended to be applicable to them. They must be dealt with on a case-by-case basis.

GH/sf

April 21, 1988
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today for my colleague, Mr. Stevenson, S-t-e-v-e-n-s-o-n, initial C., and we represent a group or four landowners in the vicinity of Site D and the names of those owners are Topic, T-o-p-i-c, Investments Limited, Seriphos, S-e-r-i-p-h-o-s, Investments Limited, Fosseri, F-o-s-s-e-r-i, Investments Limited and Framgard, F-r-a-m-g-a-r-d, Holdings Limited.

THE CHAIRMAN: Thank you.

MR. LONGO: Mr. Chairman, my name is Longo, L-o-n-g-o, initials L.F., and I represent Azova Investments Limited, one of the landowners directly involved with respect to Site F along with NSP. Mr. Chairman, I should advise that we will not be attending every day, but we will be attending the hearing at appropriate times and I thought the Board should just note that I will be absent for a portion of the hearing. The Board should also know our position, that we support the selection of Site F.

THE CHAIRMAN: Thank you, Mr. Longo.

Are there any other legal counsel?

MR. RENAUD: My name is Renaud, R-e-n-a-u-d, initial P. and I am appearing for Cumis Group Limited, C-u-m-i-s, adjacent property owners to Site F.

DR. KINGHAM: Can we understand that in terms of the chloride profiles here that below the red line is essentially old water geologically?

MR. PETRIE: We can understand that.

DR. KINGHAM: Above the blue line is relatively fresh water?

MR. PETRIE: Recognizing that as water exfiltrates from a landfill at the site and moves generally downslope, it is going to pick up more mineralizations as it flows and the chloride levels would increase from left to right and the water would still be modern in the general sense.

In consideration of all I have learned from the new data provided since I have been here and the additional interpretations considered, in my mind the site is poorly defined and I feel it cannot be easily monitored and I cannot make predictions regarding the rate and patterns of contaminant migration that may occur at this site and with respect to the criteria we developed on hydrogeologic suitability, I believe Site F is not hydrogeologically suitable.

Now, we considered an alternative landfill design of a clay liner and that clay liner would consist of a lower sand blanket, a clay liner

itself and then a sand blanket and leachate collection system on the upper side of the liner and the refuse would be deposited above that again. We believe that that liner is a feasible alternative in order to make the site environmentally sound. It does in our mind give us greater confidence with respect to prediction and we have a greater capacity to monitor. We can monitor the sand blanket directly beneath the liner for a compacted, installed clay liner and we would have an understanding of its properties, its porosity and hydraulic conductivity, and would be able to make predictions regarding the rate of diffusion or the rate of contaminant transport through that liner and have a reasonable handle on the capacity for that liner to provide attenuation. Given that we can monitor the base of the liner, it provides us the capacity to monitor the site. Two questions or two points were raised during cross-examination regarding the liner and these we feel are design issues. One relates to the position of the water table vis-a-vis the liner and if the liner is at -- if the water table is at the base of the liner we have calculated one hydraulic gradient across that liner and if the water table is at the top of the liner we have a different hydraulic gradient across that liner. Thus the position of the water

table with respect to the top of the liner is yet to be evaluated and we feel is a design issue respecting the design of a liner.

The second issue raised is the geotechnical considerations with respect to installing a compacted clay liner on one part on rock, and that would be the portion of the rock which would be removed so you would be dealing with a more fresh rock surface and, secondly, the clay liner to be installed on infilled material, infilled into the stream fillings so you would have two base materials on which the liner would be constructed. Those are geotechnical considerations and again can be addressed in a design aspect of that liner. We feel the liner does provide a feasible alternative to make the site environmentally sound.

DR. KINGHAM: Do you know of any case where an attempt has been made to put a liner on an incline on two different base materials and the liner has survived?

MR. PETRIE: I do not and could not speak to that.

MR. CRUTCHER: If I may add, I hope to be able to address that a bit more in the operations portion.

MR. PETRIE: To sum up again, the tritium and chloride data can be viewed as providing a measure of those portions of the rock which are more hydraulically active and ignoring some of the tritium data and it may be appropriate to do that and indeed it could be verified by additional tritium sampling and it would make it a less complicated picture or more consistent picture vis-a-vis the chloride and tritium for the more hydraulically active portions of the rock. We feel exfiltration from the landfill or -- 50 millimetres per annum is a good number, but in consideration of all of that I still feel there is difficulty in predicting the performance of the site and being able to monitor the site and there is some measure of uncertainty as to how effective purge wells would be to control contaminant migration should it occur and the liner alternative, and there are some design issues which must still be evaluated at greater depth, but we feel the liner provides us with the capacity to predict and monitor the site and, in that sense we believe the liner would make the site environmentally secure and more safe.

MR. McQUAID: Thank you, Mr. Petrie. Those are all my questions. Thank you, Mr. Chairman.

MR. LANCASTER: Thank you, Mr. McQuaid,

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MR. LANCASTER: Please be seated.

MR. McQUAID: Q. Mr. Crutcher, I would like you to turn to B-861, your report dealing with design and operation on Site F, please. You have explained to us this morning that Part A is general design criteria, or discussion for both sites, setting out as it were, the background of design criteria for both sites based on the evidence and other reports which have been heard in this hearing.

MR. CRUTCHER: A. That is correct, Part A essentially has the same format as Site D but has different information because of the hydrogeologic design criteria and the information from the various consultants dealing with the other disciplines. I should note that one of the most significant components of Part A which is different than what Mr. Hiraishi had to deal with is that we concluded through CRA's assessment of the hydrogeologic review of Site F that the site would be suitable only with a liner. That is put forward in Part A of the report.

I don't think it is necessary to go through that basis. A great deal of testimony has been provided already dealing with that particular aspect on the liner.

I thought it would be advantageous to prepare a schematic of the liner so the information was presented and reasonably interpreted. I have therefore prepared a schematic of the liner. It is as described in the text on page 56 and page 57.

I felt the schematic would help illustrate the concept. I have undertaken to also make a reduced version of this schematic for all members here to assist in their review.

The reduced version is identical, just on a smaller scale.

MR. LANCASTER: We should mark the big plan. B-864.

--- EXHIBIT NO. B-864: Schematic of the clay liner, Site F

MR. CRUTCHER: The title on the plan is "Schematic of Clay Liner Site F" and is now labelled as Exhibit B-864.

The features of the liner, if I may just go from the top to the base, I will try that the other way around. I will go from the base up because it is the way you construct a liner. The slope of the liner would coincide to the slope of the landfill site as depicted by Mr. Hiraishi. In fact, the grading would be quite adequate for that. Once the site was pregraded you would install a 0.3 metre sand blanket.

That sand blanket would have a permeability of greater than or equal to 10^{-3} centimetres per second. Within that sand blanket, there would be leachate detection tiles, essentially the same configuration as the leachate collection pipe. We, at this time, have conceptualized that the top of those tiles would be placed approximately every 100 metres rather than 50 metres as depicted for the leachate collector tile. They would terminate in manholes on the periphery of the site very similar to the manholes for the leachate collection system.

The liner would then be placed and it would be placed under the direction of a geotechnical engineer such that it would maintain integrity or placed with an integrity of K less than $1x10^{-8}$.

We are specifying that that thickness should be 1.2 metres. The thickness of the liner is a rather difficult item to come up with. We noted more what the industry has been utilizing and we note within the text that the industry typically uses between one metre to 1.5 metres.

In Ontario where I am aware of liners, the thickness at the Keele Valley site is 1.2 metres and the sites down in St. Catharines, which I referred to earlier, being the Walker Bros. and Glenridge site,

I believe the thickness of the liner is these locations is 1.5 metres. We have indicated a thickness of 1.2 metres. Above the liner again, a sand blanket. That sand blanket has two purposes.

First, it protects the liner from damage due to construction and placement of refuse; and secondly, it allows for the control of the leachate head. That sand blanket would have the same design as the blanket below, that being $1x10^{-3}$ centimetres per second.

The leachate collector tile in this case would be placed in the same configuration as Mr. Hiraishi has developed it and as we recommended some minor amendments to as presented on Figure C2.1.

We also note mounding. You will see on the figure we illustrate the leachate mounding. As I testified to when I was dealing with hydrogeology, the mound in the design condition would be within the sand blanket itself, approximately 0.3 metres. The dotted red line on Exhibit B-864 depicts the maximum elevation of the mound and it just intersects the refuse, the average elevation is within the sand itself.

There is an exaggeration to the scale. It is plotted at two scales so that you can get a relationship, but it is exaggerated by a factor of 10.

Q. Could you explain to the Board why you have recommended first the sand blanket below the clay liner and then the one above?

A. The sand blanket below the liner is for two purposes, essentially three purposes.

Firstly, it provides a base on which to construct the clay liner, a good well-graded base to construct the clay liner. The sand blanket would then be used for detection of any migration of leachate through the liner itself. Within that, as I have indicated, we have put leachate collection pipes or leak detection pipes should it be leaking and it would be leachate collecting pipes. The third point is it acts as a contingency measure where we can pump the leak detection tiles to capture any leachate that may pass through the liner and subsequently would sent back for treatment.

The sand blanket on top of the liner firstly provides protection to the liner; and secondly, allows for the reduction of the leachate head within the site. That sand blanket is very similar to, in fact, the granular blanket which we referred to at Site D. That serves the same purpose. It would be required regardless of the leachate mounding for protection of the liner itself.

Q. Right. Now, you have noted on B-864, native shale bedrock or landfill in the materi upon which the blanket and the clay liner would be constructed. I want to ask you to go back to the question that I guess Dr. Kingham put to you when you were here on the hydrogeology panel, to comment upon the aspects of whether or not such a liner can be placed on this native shale bedrock or backfill without any problems with respect to settlement or anything of that nature.

A. I answered, I was a little surprised by Dr. Kingham's question on dealing essentially with the settlement of the liner in the valleys because at that time I had not really considered it as a particularly major issue, but I didn't feel I could answer that without proper consideration.

So, I went back to our geotechnical people at the firm and posed that question to them. I just want to find one -- I am referring to Drawing 6R. I believe that is in Exhibit H-42. What I ...

Q. It may be H-42B, sir.

A. It is the revised drawing.

The question I posed to our geotechnical people was the way I understood Dr. Kingham's question

was that if you take, for example, Section D which is illustrated on Drawing 6R, you will see that there is a significant infilling of the valley and placing of the base of the landfill site on native shale bedrock. The question that was posed to me was, in fact, would I be concerned about failure of the liner at essentially the fill location.

So, what I suggested that they look at was, in fact, if we could calculate out what, in fact, the settlements would be in the fill areas and, in fact, use Section D, which turned out to be a fairly worst case for the site.

We are looking at something like a five or six-metre infilling of the valley in a somewhat similar taking off of the hills. Their initial comment was they did not feel that there would be much of a problem but they went through the exercise of actually doing the calculations. The bottom line of the review was that, in fact, they had benefited by some work that was undertaken by Morrison, Beatty back in 1981. They had asked Golders to do some compaction testing on the shale itself.

So, there is a report within the Morrison, Beatty Report, which provides what I would call background information on the compaction of the

shale and the Procter densities and such. We don't need to refer to it, but we used that information, the elevations as presented on Section D and did a calculation of the actual settlement within that particular area with a loading of approximately 25 metres of refuse on top of the liner.

The calculations indicated that settlement would be anywhere from 55 to 75 millimetres. That is a settlement, a vertical settlement. We also note that that interface between the native and the fill area would not, in fact, be vertical. So, when you are talking, I will refer to that as inches, a two to three-inch settlement, that is a settlement over a fairly significant area so there will be a very slight dip in the liner, or conversely you can overbuild that area by that very small amount.

The one caution that they provided was, in fact, that the slopes that the cuts were in the valleys would have to be approximately three to one. So, in fact, you did not have a significant grade change where there is settlement that will occur, so it is evenly spread around settlement.

The settlement or the effect of a two to three-inch settlement on the liner, the thought is that that would not even be measurable and the clay itself

has a certain plasticity and in fact, it will bend. We did not foresee any problems itself.

As the other part of the question that was posed to me by Dr. Kingham was, is there any particular examples you could refer to? Our firm is quite extensively involved in quite a number of remedial works at sites. This aspect of a lining in an area where, in fact, the soils are questionable below is, we have been quite involved in that particular area. The area -- I cannot give you an example on shale that directly applies, but in fact, there is a number of sites where, in fact, we have placed a liner over fill areas. That being in one particular case, an old building was demolished. It was placed down into the hole. Everything was compacted, the liner was placed on top of that for the remainder of the waste areas. We were cleaning up a whole site. In fact, that went through a full review and the concerns with settlement were addressed and were not a major concern.

I should also note that in that particular case, the liner was a synthetic liner, being polyethylene, but the same principles apply.

So, I think I have provided to you, Dr. Kingham, a guess off the top of my head of an inch or two of settlement and word gets back to me that two

to three would be a bit closer.

Q. Any other observations that you wish to make with respect to the liner, Mr. Crutcher?

A. I note with -- not dealing with the hydrogeological aspects of the liner, but the actual placement, once the site is pregraded essentially to the grades as presented by Mr. Hiraishi, the liner placement is rather straightforward and standard engineering practice and the integrity of the liner, you can have a high assurance on the integrity of the liner and we have, in addition, the ability to monitor that for verification purposes.

Q. Then continuing in the report at page 57, there are some recommendations made with respect to the access road and site facilities. Could you just explain?

A. These are quite small points and in fact, I think they are probably best dealt with by Mr. Mereu when he deals with the costs because it would be a little more efficient to put that in at that time.

Q. Stormwater collection and control management?

A. As we indicated in Part B one of the comments primarily from the Halton Region Conservation Authority was the methodology used for

--- Upon resuming at 2:00 p.m.

MR. LANCASTER: Thank you, please be seated. Do you have any cross-examination of these witnesses?

MR. HODGSON: No, I do not.

DR. KINGHAM: Mr. Gray, I just have one question for you and it is really very much on the lines of the question I asked Mr. Crutcher.

You used the expression in your cross-examination this morning, that the clays when compacted to 95 per cent standard Proctor, would be virtually incompressible. Nothing is really absolutely incompressible, is it?

MR. GRAY: No, you are quite correct. Considering the fact that the base would be very uniform in terms of the native weathered shale or the well compacted shale that has been infilled in the valleys we have only a metre of clay that is compacted. If you took a fraction of one per cent of the thickness of the clay liner, you are really talking in terms of millimetres. If you could even measure it in terms of the compressibility due to the refuse over top.

DR. KINGHAM: The question I had put to Mr. Crutcher, and I eventually want to put to you, had to do with the whole layered structure that one would

have. Your plan as was the plan of the Region and CRA's plan, is to fill in the river valleys or stream valleys.

MR. GRAY: That is correct.

DR. KINGHAM: With, in your case, shale.

MR. GRAY: That is correct, yes.

DR. KINGHAM: You compact the shale and you told us it would be graded on the sides of the stream bed.

MR. GRAY: That is correct.

DR. KINGHAM: What is the deepest valley you have to fill in?

MR. GRAY: It would be in the order of six metres.

DR. KINGHAM: You have six metres or so of shale and then one metre of clay also compacted.

MR. GRAY: That is correct.

DR. KINGHAM: Then you would have the refuse placed on top of that. Do you have any sense of what the slope is of the landfill from the northwest to the southeast lie of the land?

MR. GRAY: It is fairly gentle. I think there is about -- I don't know the specifics in terms of the overall trend, but it is about a five per cent slope overall, regionally. Once you get into the area

of the watercourses, some of those side slopes are close to 45 degrees. I think the concern that we would have and I know I read testimony in regard to it, is the potential for differential movement of the liner. If we were putting our liner right on the shale, the native shale and on areas, if we didn't cut back and sort of feather the transition zone, if we made it very abrupt like it is out in the field, you could have, within a distance of maybe from here to the end of the room where the clay liner is sitting on the incompressible native shale and as much as maybe 10 metres away, it would be sitting on that deep thickness of compacted shale.

In that transition zone, you might be worried about stress and strain on the liner.

DR. KINGHAM: Is that your plan or your understanding of Mr. Hiraishi's plan as well?

MR. GRAY: There was testimony given regarding the order of magnitude of settlement even considering the six metres of compacted material. It was only going to be 50 millimetres, plus or minus, a matter of a few inches, but looking at the concepts, not only theoretically of the settlement of the clay liner but the practical aspects in the field you couldn't have dump trucks going up 45 degree slopes.

You would be knocking off the caps of some of those hills and slopes just to get them three to one or even flatter, so scrapers and your trucks could be mobile around.

DR. KINGHAM: Do you know what the loading of refuse is going to be in terms of tons per acre or pounds per square foot or whatever?

MR. GRAY: I don't know.

DR. KINGHAM: Do you know what it is going to be relative to the other landfill in the area?

MR. GRAY: I would only be guessing. I think it is 30 or 40 metres of some sort. It is significant. I know the settlement analysis that was gone through for our firm at Keele Valley. We were looking for 200 feet of refuse. We were interested in that same potential problem of settlement of the liner and the matter of the subgrade performance.

But, in that case, we had granular soils that were going to settle almost immediately under the weight of the new fill. Here, except for those infill valleys you are talking at least an order of magnitude less compressibility in terms of the weathered shale as opposed to a sand and gravel.

DR. KINGHAM: So, as was my question to Mr. Crutcher at the time, do you have any knowledge or

experience of a situation where stream valleys have been filled with one kind of material, in this case, weathered, recompacted shale on undisturbed shale and then had a liner placed on top and refuse placed on top of that.

MR. GRAY: To answer your question very specifically, I haven't got any experience in that scenario, but I know from the work that I have done with analysis of subgrades for tailings dams where we are putting 50, 60 feet of compacted earth over subgrades, we often have to remove peat and organic material, we have to blast rock to fit in the compacted fill. It is something that if there is proper attention given to the design dovetailing the transition zones, you don't normally have a settlement problem if you have got strict quality control and your benchmark is high enough, like the 95 per cent Proctor density.

If that can be achieved, then the settlement isn't really an issue.

DR. KINGHAM: The other side of that coin, I guess would be if you assume a relative incompressibility and a saturated remoulded shale. Do you have any concerns about the plasticity of the material under that loading at the bottom side of the

landfill?

MR. GRAY: No, in fact, the moisture really is added to facilitate compaction, to facilitate density and permeability to have a low level of permeability.

As I say, by knocking off and really over-excavating, there will be areas that you could stop and have the material one metre below your design landfill level, but the slope would be too steep.

So, from a practical standpoint, from a construction standpoint, you over-excavate to get a three to one slope through those areas of steeply sloping side ...

DR. KINGHAM: Perhaps you are not understanding my question. Perhaps I will restate it so that it is absolutely clear to both of us. You have undisturbed shale into which you have put remoulded shale, if I can call it that, on top of which you put a liner and landfill. The result being, based on the evidence we have heard here, that there may be a lot of water content in that strata beneath the liner, perhaps saturated with water.

Do you, as a geotextile expert, have any concerns about slumping or other deformation of the material now which is saturated and lying beneath that

great mass of refuse?

MR. GRAY: I wouldn't have the concern as long as the shale is placed and compacted properly. If it is put in a loose state, then with time, the moisture and the leachate that would infiltrate could cause softening of the shale and you could get some uncalled for settlement.

If there is the quality control during the placement of the shale, it will be dense enough and strong enough that it will be virtually incompressible relative to the loads that are on top of it. It wouldn't give, induce settlement.

DR. KINGHAM: That is the compressibility question again. You said virtually incompressible this morning. If you have a virtually incompressible substance in the tube and you squeeze the tube, what happens to the virtually incompressible substance?

MR. GRAY: We are talking a situation where if the soil wasn't compacted and water could get into the material, it would lose some of its strength and density and with the weight on top of it, there could be some collapse of the soil structure. But we are going to do the best we can in placing the material in thin lifts and to reduce all of the void space so

that it has such a high density there isn't the pore space for the water to get in and cause any softening.

DR. KINGHAM: Thank you.

MR. LANCASTER: Mr. Estrin, re-examination?

RE-EXAMINATION BY MR. ESTRIN:

Q. Mr. Gray, dealing, first of all, with the question from Dr. Kingham, I wonder if we can go at that again to the extent we can address it in another way.

Dr. Kingham used the analogy of a toothpaste tube. Perhaps if we imagine some analogy of the toothpaste tube to the concept that the valley is somehow going to liquidize or something like that once you start filling it in and have water coming into it, I am not sure. The concern seems to be filling in a valley with something and then what happens with water getting into that?

Do you have any concern in that sense of it moving?

MR. GRAY: A. We have had examination of some of the performance of shale in sewer trenches were again there may have been not as much quality control as might be desired. The shale, if it isn't broken down properly by the equipment, tends to go into

the trench in maybe thicker slabs and you can actually have some voids in the actual backfill.

When water is allowed to percolate in through the backfill, it can soften the contact points between the shale and as the water and shale combine, you will get some slippage of the soil and rock in the trenches. That is the aspect that I think possibly would concern about the flow of water through the valleys that there could be this softening of the material and subsequent settlement after the fact.

It might even be a year or two after the actual material is in, but if we densify the material as we build up the infilled valleys there isn't the void space and the actual shale is broken down such that we don't have ...

DR. KINGHAM: I think you are trying to answer the question and Mr. Estrin is very helpfully trying to state it clearly, but I think you still haven't got it. We are not talking about void space here. We are talking about the analogy between wet cement and hardened cement.

If you fill the river valleys with hardened cement and put garbage on top, you would not expect that cement would ooze out of the bottom of the river valleys.

If you filled it with wet cement and were instantly able to put 1,000 tons of garbage on top, you would expect to squeeze all of that cement out of the river valley. Where does your remoulded shale fit into that spectrum between something that will slump out under the weight of the garbage and something that will remain absolutely fixed under the weight of the garbage.

MR. GRAY: It is very close to the far end of the scale where things are fixed. It just doesn't have that moisture content to flow as a toothpaste type material.

DR. KINGHAM: Thank you, Mr. Estrin. That is what I think we looked for in the first set of questions.

MR. ESTRIN: Q. Mr. Gray, some questions then arising from cross-examination and particularly that of Mr. Tzekas. He asked you in some detail about your experience and in particular, your experience with landfills. Your opinions here to the Board, centrally deal -- I take it you would agree -- with the issues of practicality of constructing a liner. That is one issue that you have addressed an opinion on.

MR. GRAY: A. Yes, I have.

monitoring programs to date are highlighted as noted at the page of 86 by the fact that unless you have screens in these more transmissive fractures, you can't be sure of the results you are getting. Mr. Feenstra is in a sense saying the way Gartner Lee should have put those screens in, are as I have defined in the portion of volume 46 that I just referred the Board to. Summarized really on pages 86 and 87 of the CRA report.

So, the first portion of section C that I was indicating to the Board comes down to page 150 and for the reasons that you have heard and are summarized here and just highlighted, CRA concluded the site did not meet the criteria and indicated the site in their opinion was not hydrogeologically suitable.

Then at page 151 and following over to page 160 CRA followed with an assessment of why a liner and an alternate design based on a liner would be required in order to make the site hydrogeologically suitable for landfilling.

I guess at this point I am in a sense saying to the Board, let us stop for a moment and look at what was said with respect to whether a liner should be part of the approval of Site F if that were selected by the Board. The reason, as advanced, as it were, by CRA and by the subsequent evidence for a liner. That

is one of the main issues which the Board will have to determine, whether this liner recommendation as put forward in 617 should be adopted or whether it is necessary to make the site hydrogeologically suitable.

There is reference in this report as you know as well as in Mr. Bowen's report, to the liner being required.

Now, dealing at page 140 in the middle of that page, having summarized in the first paragraph the interpretation why it was not hydrogeologically suitable, CRA say:

> "A landfill at this site as presently designed does not meet the criteria of predictability given that some degree of off-site groundwater contamination can be expected from the proposed landfill site at Site F, the acceptability of this contamination must be examined. Unfortunately a strictly technical test of acceptability is not possible. This follows necessarily from the argument that the local pattern of contaminant migration cannot be predicted. That is if the direction, concentration and extent of contamination cannot be

is no question that if you can identify such a horizon to begin with, indeed we will be able to collect more. The question and uncertainty here is where in fact is the thin blue line.

In regard to the liner issue, it is our submission that if Site F were approved that there should be a condition that a liner is necessary. We have heard evidence about the need for a liner from CRA and Mr. Bowen. The major reason for a liner is the fact that with one, one can predict the amount of leachate escaping from the shale. Presently, I think it is fair to say we don't know exactly what the permeability of the fractured zones are at Site F. It will be this permeability that controls the leakage into the shale. This is an uncertainty. The liner gives us some certainty. As well, as the testimony of CRA and Mr. Bowen, there are some comments of Mr. Sobanski that may be relevant.

On page 8672, I questioned Mr. Sobanski about the liner and at that time he stated that 10,000 cubic metres a year would be escaping into the shale and that a liner might cut off the leakage approximately by half to 4400 cubic metres. At that time the calculations were based on the fact that the liner was going to be 10^{-8} permeability and the weakly

fractured shale was estimated to be 10^{-7}.

The first point I would like to make here is that Mr. Sobanski agrees that at the 10^{-7} permeability which is the key, I think that is the whole trick. It is the permeability of the shale that is the key as to how much goes into it. If you have, obviously, the same permeability as your expected liner, 10^{-8}, then you don't need a liner. If the permeability is greater, then the argument for a liner becomes stronger and if -- of course, the higher the permeability away from the 10^{-8} liner, the more -- the same amount will seep through but you will be collecting more on top of that liner.

Now, Sobanski agrees that it was estimated that his 10^{-7} was estimated and agreed that if permeability were higher, in other words, $10-^{6}$, that the leakage rate without a liner would be 100,000 cubic metres a year. I think my point here is similar to the point I think Mr. McQuaid was making yesterday, that with a liner there is a certainty about what will be leaking out beneath it. The key is that we will be able to know what the permeability of the liner is. We don't know, to this day, what the permeability of the transmissive fractures will be. That is the point of my example with Mr. Sobanski was to show that 4,400 out

of 10,000 may not seem that much, although I would still submit that is significant. Forty-four hundred instead of 100,000 cubic metres a year is a lot more impressive.

In my cross-examination of Mr. Feenstra, I had a discussion with him about how the number of 10^{-7} was derived. First of all, as we had heard, it was an assumed number and Mr. Feenstra confirmed it wasn't derived from field measurements. I then took him to the Trow permeability data and first of all, Mr. Feenstra did agree that, if you like, the HC series of wells were the only wells where we had the detailed logging done and where we can tell where the highly fractured unit is. That is at page 10,233.

Going through the permeability data for the so-called weakly fractured zone, Mr. Feenstra agreed that out of 13 results, four had a permeability of less than 10^{-7}. Nine were greater than 10^{-7} and six out of 13 were an order of magnitude or more more pervious.

I suggested to him wouldn't it have been more conservative to assume a permeability of 10^{-6}. Mr. Feenstra said assuming the intervals drawn on H-220 are the definitive infiltration that on that basis it appears that 10^{-6} might not be an inappropriate number

to use as a horizontal hydraulic conductivity number. That is found on page 10208.

We also had a discussion about the thickness of the unit where I was suggesting that the unit in reality was much thinner than modelled. Mr. Feenstra agreed that the actual values that were used for hydraulic conductivity and thickness were not the most conservative values which could have been applied. That is 10226.

Of course, now we know the evidence is that the permeable zones and the active zone may be in the order of 10^{-4}. The fact is that a liner will provide certainty about the leakage into the shale. This is a point that Mr. Bowen makes in his report in testimony. As well, he pointed to the need for perimeter drains and purge wells to cut off the active zone. It must be remembered that Mr. Hodgson, who did not cross-examine Mr. Bowen, tried instead in argument to try and torture the transcripts to get a contrary view. With respect, Mr. Chairman, there is no basis on which to come to any other conclusion than that Mr. Bowen was recommending a liner for Site F on the basis of added certainty.

We have heard already that there is no certainty the active zone will actually be cut off

completely. We must remember that Mr. Feenstra initially was only talking about drains to a depth of five to six metres even though the zone may range from zero to 20 metres. If the active zone is not cut off, then there will be a percentage of leachate which will be able to travel laterally and discharge to the surface waters that run through the Aldershot community. As well, the drains may fail. If they do, travel time through the active zone will be very fast and surface water may again be affected. A liner would provide some certainty.

In my submission, the Board, if they approve Site F, should do so with a liner and a perimeter drain purge well set up as proposed by Mr. Bowen. It is my submission that it is not a redundancy given that we have no guarantee of whether the drains will be able to cut off flow in the active shallow zone.

Now, on the issue of contingencies, the Milton interests have argued that with the Feenstra fracture theory and any installation of purge wells at Site D, that there is no contingency plan before the Board. I disagree.

First of all, I will be saying more about this later, it is my submission the Board should

the new legislation. It is not only a case it could be surrendered at any time if that legislation goes out. It will in fact expire unless an active step is taken to renew it by the owner.

In my submission, to the extent that Mr. MacNaughton's evidence is inconsistent or at odds with these various other parties, you should take that into consideration in determining whether or not to accept his evidence and his position.

The seventh point I wanted to address you on, relates to the question of a liner at Site D or at Site F. That is how I have characterized the issue. It is obviously a potentially lengthy one and I don't intend to go into it at great length. I would like to make the submission that in my view there is a serious inconsistency in the position that has been advanced to you by the City of Burlington and by the Burlington Citizens Group regarding the issue of liners at these two sites.

In my submission they have both asked you to reject Mr. Feenstra's hypothesis, and conclude that a liner is not required at Site D, and in my submission, on the evidence before you, that can only be concluded to be a gamble with public health and safety. Both Burlington and the West Burlington

It is clear on the evidence that other municipalities have quarries or pits with liners as landfill sites. You heard the example of Metropolitan Toronto, you heard the example of the City of St. Catharines. You have also heard that Halton is fiscally sound. It is my submission that other municipalities find themselves in the position of being able to afford lined sites. I don't believe there is sufficient evidence for you to conclude that Halton cannot. I think you should keep in mind in that regard that the whole liner would not need to be installed all at once, or in fact paid for all at once at the beginning of the landfilling.

The beginning of the area could be lined, the price for that would be substantially lower, in my submission, than the price for the whole liner. As you have heard this is a self-supporting industry, if you like, in Halton in the sense that the entire costs of the waste disposal system are paid for at the gate, and if the liner is necessary at Site F the initial costs can be borne in my submission. Subsequent costs can be paid for by whatever adjustments to the tipping fee are necessary without there being any unreasonable burden on the taxpayers in the Region of Halton.

In my submission a conclusion that a liner is necessary at Site F is not a sufficient reason for concluding that my clients should be expropriated from their homes and properties against their will. In my submission your choice is not between a site at F and a site at D, but your choice, in my submission, in practical terms, is a site at F with or without a liner.

In my submission the evidence is clear that that is the appropriate result one way or the other.

I would also note as perhaps a footnote that I suspect we have spent more money arguing about a liner at Site F at this hearing than it would cost to install one.

Mr. McQuaid gave you, in his argument, some liner efficiency calculations. In my submission those are not of particular assistance to the Board. It is my submission that the critical point is in the first column of those pages, and that is that the ex-filtration rate without any liner would be approximately 10 to 20 millimetres per year. It is my submission that a reading of Mr. Feenstra's evidence in whole makes it clear that it is on that basis that he concludes that a liner is not necessary at Site F. He