Ex. 76

IN THE MATTER OF AN APPLICATION
BY THE REGIONAL MUNICIPALITY OF HALTON
FOR THE CONTINUED USE OF THE
BURLINGTON LANDFILL SITE

Witness Statement

of

I.R. PAWLOWSKI
Hydrogeologist
Waste Site Evaluation Unit
Waste Management Branch
Ministry of the Environment

C U R R I C U L U M V I T A E

I.R. Pawlowski

I. EDUCATION

Honours B.Sc. Geology, 1972
Brock University
St. Catharines, Ontario
(emphasis on sedimentary deposits in Ontario)

II. WORK EXPERIENCE

1. Ministry of the Environment

Position: Hydrogeologist
Waste Site Evaluation Unit
Technology Assessment Section
Waste Management Branch
December 1983 - Present

Job Function:

- Background review and technical appraisal of consultants reports dealing with pollution from waste sites, hydrogeological and hydrogeo-chemical evaluations, contingency plans and remedial measures.

- Developing a practical and widely acceptable program plan utilizing the best available technology for the evaluation of landfills and other waste sites to identify and define the pollution potential.

- Implementation of a method to compile information from intensive literature review.

- Work on research projects currently includes the project management of the statistical approach to groundwater monitoring at landfill sites.

- Program Management Advisor to the Ministry of the Environment's Site Support Team, a multi-disciplinary team appointed by senior management to deal with difficult waste site pollution problems. Duties as a member of the team include:

  a) Developing effective project plans for hydrogeologic investigations for the purpose of selecting and implementing remedial measures;

  b) Developing contract specifications for remedial work;

c) Negotiation and arbitration with other hydrogeologists, Ministry staff and consultants;

d) General supervision of data collection and procedures;

e) Continuous evaluation of project plan, motivating and implementing changes essential to the success of the plan;

f) Developing special visual aids to assist in the explanation of groundwater phenomena to persons of any background; and

g) Continuous and intensive literature review and evaluation of the state-of-the-art technology useful in the execution of a project plan.

- Problem sites dealt with to date include: the Pauze site in Perkinsfield, Ontario; an illegal landfill site in King Township and the O.E. MacDougall Site in Elizabethtown Township.

- Assisting in the development of an action plan for dealing with leachate contamination from industrial wastes in the Breslau area.

2. Ministry of the Environment

Position: Project Hydrogeologist
Water Resources Branch
1981 - 1983

Job Function:

- Background review and technical evaluation of engineering reports for proposed landfill sites and other installations under the Environmental Assessment Act and the Environmental Protection Act.

- Landfill sites reviewed included York Sanitation No. 4 Site in Whitchurch-Stouffville and the Keele Valley Landfill Site.

- Background review of closed and existing municipal industrial landfills evaluating the pollution potential to groundwater.

- Work on research projects includes project management of a project dealing with infiltration through landfill covers.

- Began work in 1982 with Ministry Site Support Team.

3. Ministry of the Environment

Position: Project Hydrogeologist
Project Coordination Branch
1974 - 1981

Job Function:

- Exploration, development and design of water wells for municipal supplies throughout Ontario, including preparation of all available background information to assess potential for the development of large yield groundwater supplies and supervision of the field work on the drilling and construction projects.

- Exploration and investigation of wells for water quantity and quality interference complaints. This included review of engineering reports and recommendations for additional work required to handle local groundwater problems.

- Worked on a total of approximately 62 projects in a 7-year period, including preparation of 8 groundwater survey reports, 30 groundwater investigation reports and supervision of 17 test drilling and well construction projects.

4. Ministry of the Environment

Position: Geologist
Water Quantity Management Branch
1973 - 1974

Job Function:

- Design, development and execution of an integrated surface and groundwater quality monitoring program.

- Field supervision of intensive drilling and recharge pit construction testing program.

- Main responsibility was work on the Grand River Recharge Feasibility Study in the Kitchener-Waterloo area where the main emphasis of the work was the study of the hydrogeo-chemical effects of recharging surface water into an already existing groundwater aquifer. On completion of this study, worked on the evaluation of groundwater resources in the Duffin-Rouge Drainage Basin.

5. Steltner Dev. and Mfg. Co. Ltd.

Position: Research Assistant
1972 - 1973

Job Function:

- Design and development of an oil spill containment device, (Horizontal Oil Boom), for PACE

III. PROFESSIONAL AFFILIATION

- Fellow of the Geological Association of Canada
- Professional Affiliate of the Canadian Society of Civil Engineering
- Technical Member of the National Water Well Association

WITNESS STATEMENT

RE: Application by the Regional Municipality of Halton for the Continued Use of the Burlington Landfill Site

NAME: I.R. Pawlowski
Ministry of the Environment
Waste Management Branch

LIST OF DOCUMENTS REVIEWED

1. General Review of Documentation associated with Application for Continued Use of the Burlington Landfill Site with particular emphasis on Section O - Hydrogeological Study.

2. In addition, I have reviewed the following documents associated with the Burlington Landfill Site:

   a) Hydrogeological Study; Gartner-Lee Associates Limited, September 26, 1979.

   b) Monitoring Program Report; Gartner-Lee Associates Limited, April 18, 1980.

   c) Hydrogeological-Geotechnical Study Report Contingency Leachate Collection System; Gartner-Lee Associates Limited, August 14, 1980.

   d) Monitoring Program - Interim Report; Gartner-Lee Associates Limited, April 23, 1981.

   e) 1981 Monitoring Report; Gartner-Lee Associates Limited, September 21, 1982.

   f) 1982 Monitoring Report; Gartner-Lee Associates Limited, August 29, 1983.

   g) Possible Continued Use Report (revised); M.M. Dillon Limited, October 20, 1983.

3. In addition, I have also reviewed the following documents:

   a) Dixion, V.R., 1958, Additional Ground Water Supplies at Waterdown; OWRC file report.

   b) Funk, G. 1979, Geology & Water Resources of the East and Middle Oakville Creeks, IHD Representative Drainage Basin; MOE, Water Resources Branch, Report #12.

   c) Ostry, R.C., 1979, The Hydrogeology of the IFYGL Forty Mile and Oakville Creeks Study Areas; MOE, Water Resources Branch, Report 56.

d) M.O.E., 1972, Lake Ontario Drainage Basin, Overburden Well Yields; Map No. 5926-2, scale 1:500,000.

e) M.O.E., 1972, Lake Ontario Drainage Basin Bedrock Well Yields; Map 5926-1, scale 1:500,000.

f) Acres Consulting Services Ltd., September 1972, Solid Waste Management Strategy Study, Final Report for the City of Burlington.

g) Morrison Beatty Ltd., November 1981, Phase III Hydrogeologic Investigation, National Sewer Pipe Ltd., Landfill Site, Burlington.

h) Morrison Beatty Ltd., July 1979, Progress Report on Phase I, Hydrogeologic Study, National Sewer Pipe Ltd., Proposed Landfill, Burlington.

i) M.M. Dillon, June 1981, Draft, Bayview Park Landfill Site Leachate Discharge Investigation, Phase I, including May 1981 Hydrogeologic Study, Phase I, Bayview Landfill Site, Gartner Lee Associates Ltd., for the City of Burlington.

j) Morrison Beatty Ltd., June 1980, Phase II, Hydrogeologic Investigation, National Sewer Pipe Ltd., Landfill Site, Burlington.

k) Cherry, J.A. and D.L. Lush, October 1983, Hydrogeologic Suitability of the NSPL Landfill Site, Burlington, Ontario, for the Regional Municipality of Halton.

l) Hewetson, J.P. and J.A. Cherry, April 1983, (draft) Hydrogeological Investigations at the Bayview Park Landfill Burlington, Ontario, Progress Report May 1982 - February 1983 for the Regional Municipality of Halton.

INVOLVEMENT WITH APPLICATION

I have been a member of the Ministry Review Team responsible for the review of the Application for Continued Use since February 1984. In that capacity, I have been responsible for reviewing all supporting documentation relating to hydrogeology. I have been involved in ongoing discussions with the consultants employed by the Regional Municipality of Halton, Gartner-Lee Associates Limited, with the consultants employed by the City of Burlington, Conestoga Rovers and Associates, and with the expert hydrogeologist employed by the Board, Mr. Kevin J.D. Ridley. I have visited the Burlington Landfill Site on three occasions.

EVIDENCE

1. I am in general agreement with the conclusions and recommendations expressed by Gartner-Lee Associates Limited as set out on pages 0-71, 0-72 and 0-73 of Section 0 of the Application.

2. Continued Use Area

Eventual discharge of leachate from Phases B and D to Indian and Falcon Creeks has been expressed as a concern. Since travel time through the till layer of 1.5 meters has been calculated to be between 12 and 5,000 years, with an average travel time of 75 years, leachate discharge into the creeks is not an immediate concern. It is therefore appropriate to use the post-closure infiltration value of 3.4 L/min/ha to determine ultimate impact.

Using an area of 3.8 ha, which is the estimated area of Phase B, the expected infiltration will be 12.9 L/m. With the installation of the underdrain system with an efficiency of 90%, the total volume passing the underdrain system and moving towards the creek would be in the order of 1.3 L/m.

Similarly, it is possible to calculate infiltration through Phase D. The estimated area of Phase D is 1.4 ha. The potential infiltration in this area would be 4.8 L/m. With the installation of the underdrain system with an efficiency of 90%, the total volume passing through would be in the order of 0.5 L/m.

Dealing with the potential impact on Falcon Creek from Phase D, it is conceivable that these very small volumes of leachate could remain undetectable because Falcon Creek not only draws water from this landfill area but also draws water from the other bank. This dilution can act to prevent detection of any leachate from the landfill site in the surface water.

The almost complete saturation of the till layer underneath the collection system results in gradients lower than if the till layer was unsaturated. This effectively increases the relative travel time through the till layer. As stated in evidence by Mr. Leech, the till thickness below the underdrain system will exceed 1.5 m. in some locations. In some places, thicknesses greater than 10 m. are estimated. The increased thickness will increase the travel time of any leakage by-passing the underdrain system.

The figure of 795 m^3/a, which is stated at page 0-152, is the total leakage through the minimum recommended till layer under Phases B and D, which have a combined area of 5.3 ha (in Section A of the hydrogeologic report the total areas for Phases B and D is 5.2 ha). In evidence, Mr. Leech stated that this would be equivalent to 1 to 2 L/s. The equivalent is actually more in the order of 0.025 L/s.

The anticipated impact on surface water quality from groundwater seepage from the landfill site in the proposed continued use areas would not likely be detectable, if at all, for some time after site closure. However, earlier seepage break-outs resulting in overland flow could have an impact depending on the volumes involved. With the installation of the underdrain and toe-drain systems, on site surface drainage and continual inspection and maintenance of those systems, this impact can be controlled.

However, in order to substantiate the estimates of impact on surface water, the following information is required:

a) a "snap-shot" approach to the collection and interpretation of groundwater quality monitoring data would provide a correlation between groundwater hydraulics and water quality.

b) anomalous water quality data, should it occur, should trigger an immediate confirmatory re-sampling.

c) an annual water balance calculation for the entire landfill area should be provided in the annual report based on actual leachate volumes measured in the collection system.

d) a water level monitoring borehole within the refuse in the underdrained area should be considered by the consultants in order to allow a check on any loss in leachate volumes collected by the toe-drain and underdrain systems.

3. EXISTING LANDFILL SITE

On page 0-45 of the hydrogeologic report, Gartner-Lee concludes that there is a contaminant plume moving away from the original landfill site. The limits of the plume are estimated to be between monitor locations 16 and Highway 403. Using the maximum groundwater flow velocity, it is speculated on page 0-150 that the front of the contaminant plume could be about 180 m. south of the limit of the fill. However, in Exhibit No. 34 at page 16, a figure of 100 m. is presented. It seems quite certain that the contaminant front has migrated at least 100 m. from the limit of fill.

Use of an average linear velocity is a standard approach in describing the bulk movement of leachate from a landfill site. Based on these values, one can select a distance from the landfill site where attention should be focused with respect to new borehole locations.

The inorganic and organic sampling analyses to date are inconclusive with respect to defining the configuration of the contaminant zone directly associated with leachate.

It is quite evident that a "snap-shot" approach to water quality monitoring could improve the understanding of the behaviour and movement of the existing leachate plume.

In my opinion, some general information about the movement and attenuation of leachate would be of some assistance. Figures 1, 2 and 3 (attached), illustrate general distributions of various leachate parameters based on existing information from other areas in side view and in plan view.

I would note that Mr. Leech stated in evidence that the anomalous results from borehole 17 may be the result of damage associated with the construction of the sedimentation pond. In my opinion, boreholes that are essential to the delineation of leachate contamination should be provided with an outer protective structure reducing the possibility of damage. If damage has occurred, replacement of the monitor is recommended as major repairs to these installations are practically impossible. Also, fieldnotes should include a description of any noticeable equipment damaged, as well as whether samples contained any particulates, or were cloudy or coloured. I would suggest that these notes should be appended to the annual monitoring report.

I am in general agreement with the proposed program for the further delineation of the leachate plume as suggested in evidence by Mr. Leech.

4. REGIONAL GROUNDWATER USE

A concern has been raised with respect to the possibility of a discharge of leachate within the Aldershot community. In my opinion, contamination associated with the movement of leachate is unlikely to be detected in the Aldershot area for the following reasons:

(a) The closest distance downgradient from the landfill property to any residential area is in the order of 650 m. Using a maximum average linear velocity in the shale of 15 m per year, as set out on page 0-44 of Exhibit 7 and page 16 of Exhibit 34, the travel time for bulk movement of the contaminants would be in the order of a forty years.

(b) As indicated in the hydrogeologic report, the potential for attenuation in this geologic setting appears to be substantial compared to the concentration of the contaminants in the leachate.

(c) Based on available information, shale outcrops have not been mapped in the Aldershot area drained by Falcon Creek. The overburden thickness increases in the direction of Hamilton Harbour. Figure 4 is a representation, in exaggerated vertical scale, of the relationships between the landfill site and Hamilton Harbour and between the overburden and the

bedrock. The regional groundwater flow direction is also illustrated.

Infiltration from rain and snow will accumulate in the overburden forming a watertable. It is therefore likely that fresh water overlies the poor, relatively more dense water of the Queenston Shale. This will likely preclude detection of contaminants in the Aldershot area.

(d) There is no reported use of water from the Queenston Shale in the Aldershot area. Based on water samples obtained from the Queenston Shale at the landfill site as well as in the vicinity, the water from this formation is generally high in sulfates, chlorides and iron and therefore is not potable. There is also no potential for future use for water supply wells from the Queenston Shale as the yield is extremely low.

(e) Wells in the upgradient areas as indicated on figure 0-19 on page 0-138 of the hydrogeologic report obtained their water supply at depths of approximately 10 to 15 m. Because the groundwater flow from the landfill site is towards the southeast, which is the direction of maximum gradient, there is no risk of contamination from the landfill reaching those wells.

5. I will attend before the Environmental Assessment Board and be subject to examination and cross-examination on this witness statement.

Dated this 23rd day of May, 1984.

I. R. Pawlowski

I.R. PAWLOWSKI

COMPONENTS OF A TYPICAL PLUME:
SIDE VIEW

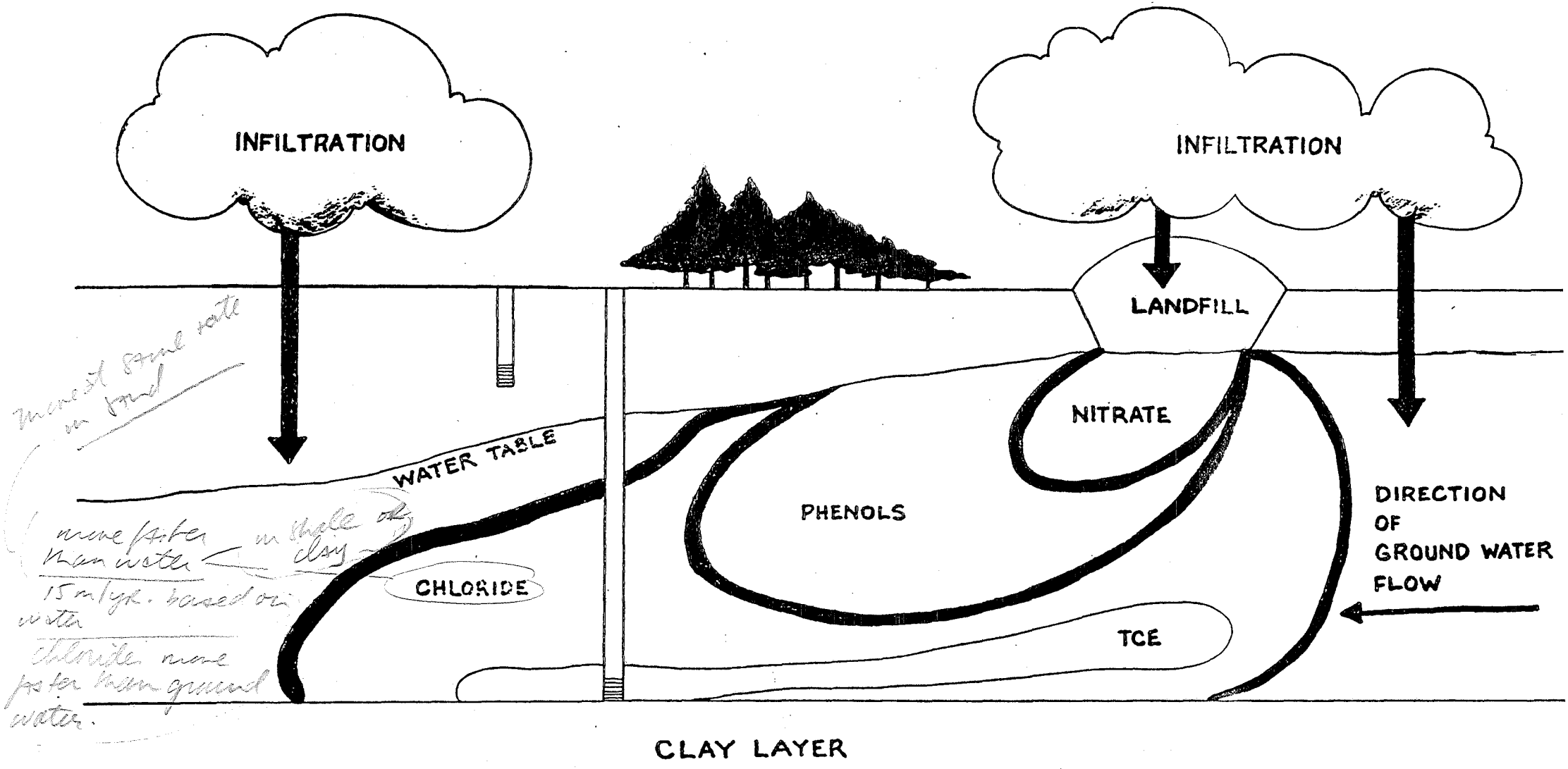

FIGURE 1

COMPONENTS OF A TYPICAL PLUME:
PLAN VIEW

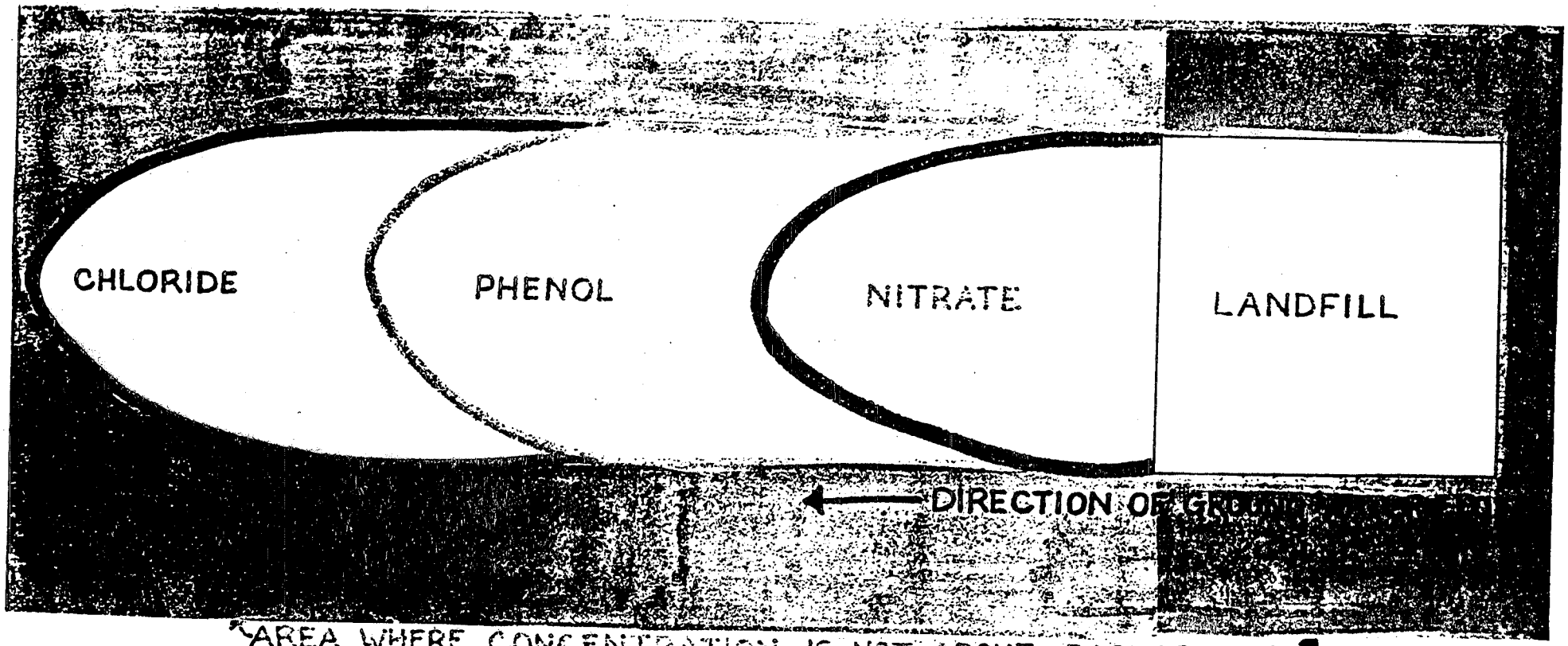

FIGURE 2

COMPONENTS OF A TYPICAL PLUME: PLAN VIEW

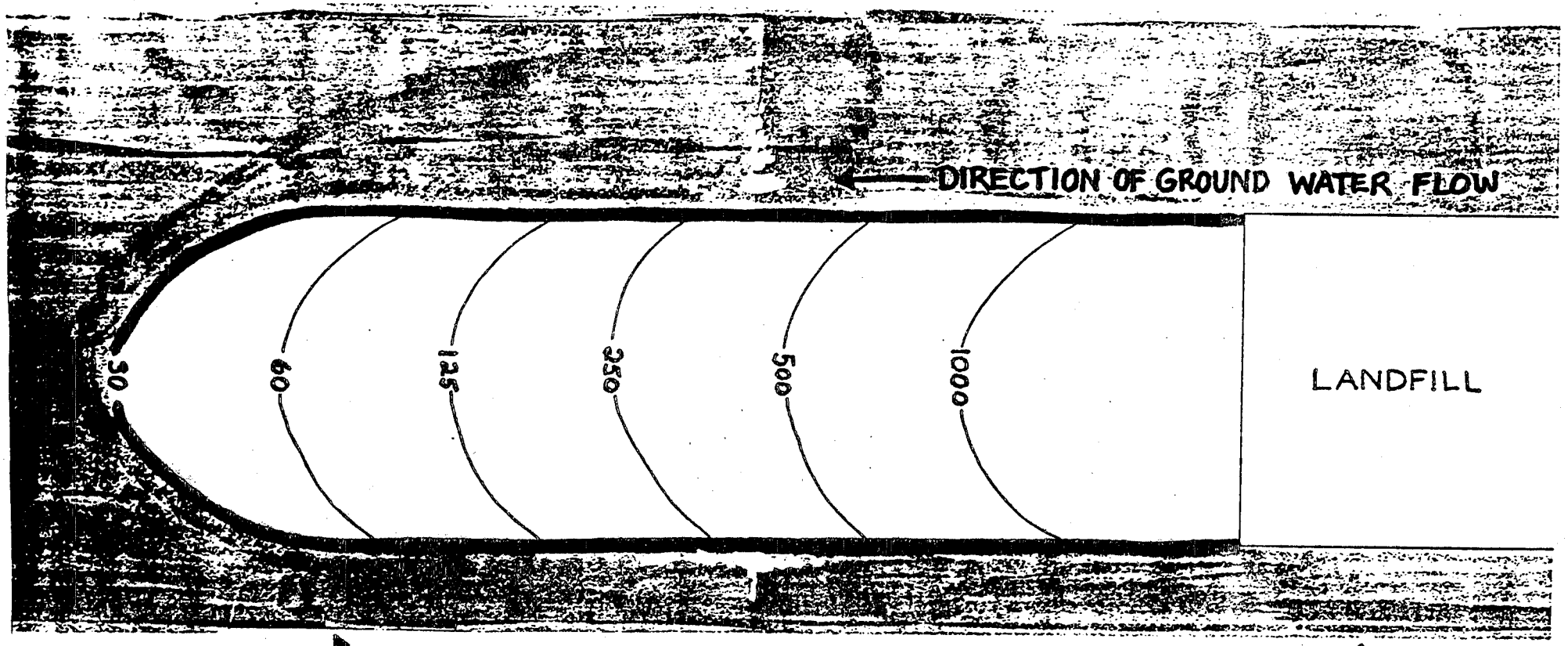

FIGURE 3

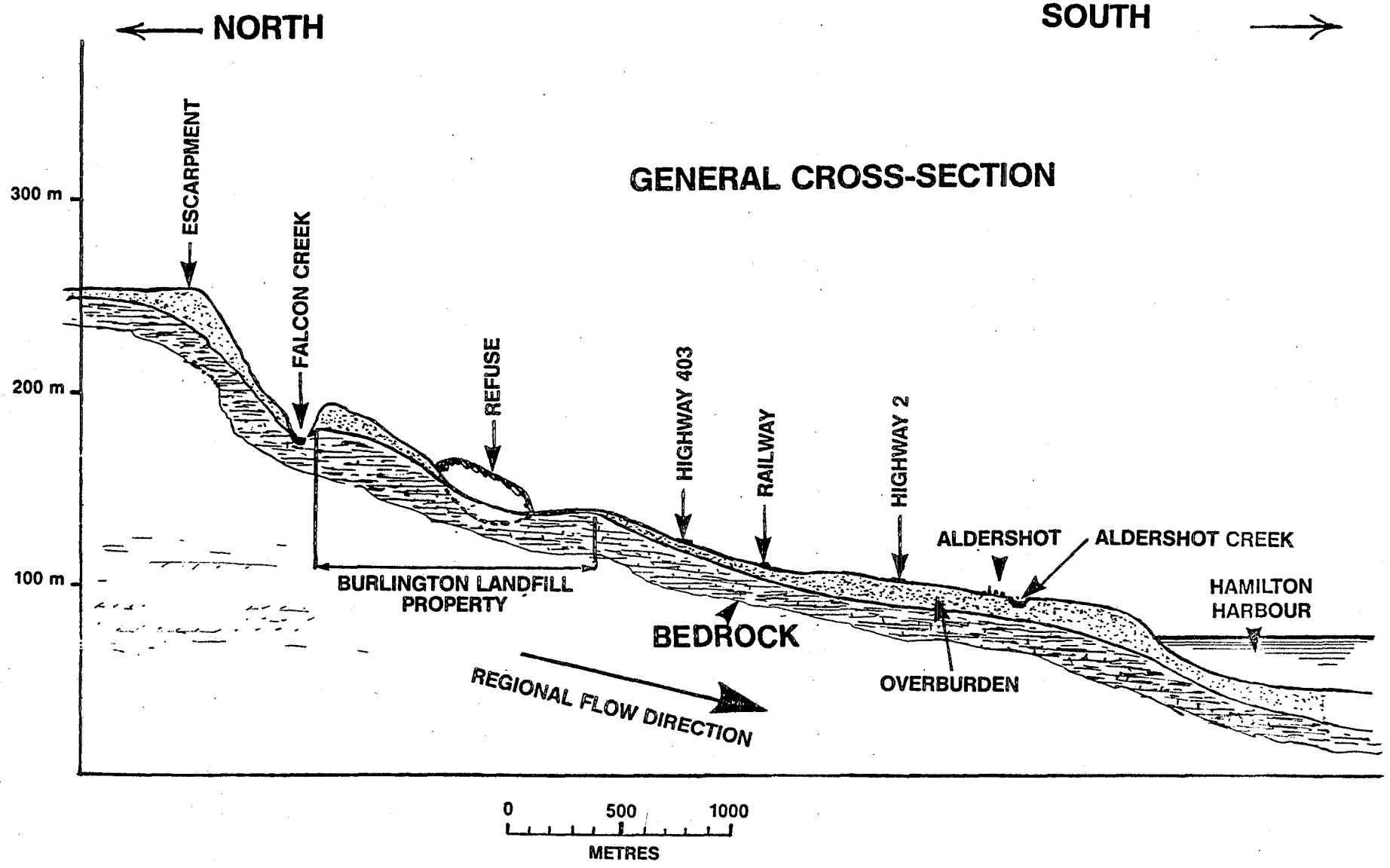
NORTH
SOUTH
GENERAL CROSS-SECTION
300 m
200 m
100 m
ESCARPMENT
FALCON CREEK
REFUSE
HIGHWAY 403
RAILWAY
HIGHWAY 2
ALDERSHOT
ALDERSHOT CREEK
HAMILTON HARBOUR
BURLINGTON LANDFILL PROPERTY
BEDROCK
OVERBURDEN
REGIONAL FLOW DIRECTION
0
500
1000
METRES

FIGURE 4