

CH-88 82

V-7-1

CONSOLIDATED HEARINGS BOARD

IN THE MATTER OF Sections 2 and 3 and 6 (3) of the Consolidated Hearings Act, 1981, S.O. 1981, c.20;

— and —

IN THE MATTER OF Section 12(2) of the Environmental Assessment Act, R.S.O. 1980, c.140;

— and —

IN THE MATTER OF Sections 30, 35 and 38 of the Environmental Protection Act, R.S.O. 1980, c.141, as amended;

— and —

IN THE MATTER OF Sections 24 and 61 (2) of the Ontario Water Resources Act, R.S.O. 1980, c.361, as amended;

— and —

IN THE MATTER OF Section 28 (3) of, and Regulation 164 under, the Conservation Authorities Act, R.S.O. 1980, c.85, as amended;

— and —

IN THE MATTER OF Section 40(12) of the Planning Act, S.O. 1983, c.1, as amended; in connection with site plan control of the sanitary landfill site;

— and —

IN THE MATTER OF Section 22(1) of the Planning Act, 1983 in connection with a referral to this Board by the Honourable Bernard Grandmaitre, Minister of Municipal Affairs, on a request by the Regional Municipality of Halton to amend the Official Plan for the Town of Milton to redesignate a parcel of land comprising Part Lots 3 and 4, Concession 2 N.S. in the Town of Milton from "Agriculture" and "Conservation and Hazard Lands" to permit the construction, operation and maintenance of a landfill site, Minister's File No. 24-OP-0208-A01;

— and —

IN THE MATTER OF Section 34(11) of the Planning Act, 1983 in connection with an appeal to this Board by the Regional Municipality of Halton for an order directing an amendment to By-law 61-85 of the Town of Milton to rezone the lands situated at Lot 3 and part of Lot 4, Concession 2 N.S., in the Town of Milton from "Agriculture" to permit a regional sanitary landfill site and ancillary uses;

— and —

IN THE MATTER OF Section 15(1) of the Planning Act, R.S.O. 1980 ch.379 in connection with a referral by the Honourable Claude F. Bennett, Minister of Housing on a request by Tremaine Britannia Citizen's Group for consideration of part of the Official Plan for the Halton Planning Area with respect to Sections 1 to 5 inclusive, 7, 9 and 10 of Part III D3 Solid Waste Management, Minister's File No. OPC-0026;

— and —

IN THE MATTER OF Section 64 of the Ontario Municipal Board Act, R.S.O. 1980, c.347 as amended in connection with an application by the Regional Municipality of Halton for an order approving:

a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site 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;
- (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton

at an estimated cost of \$12,775,000.00, and the borrowing of money by way of temporary advances not exceeding in the aggregate such estimated cost pending the sale of debentures, and

(b) the issuance of necessary debentures to a maximum of \$12,775,000.00 for a term not to exceed fifteen years;

— and —

IN THE MATTER OF Section 193(5) and Paragraph 84 of Section 210 of the Municipal Act, R.S.O. 1980, c.302, as amended;

— and —

IN THE MATTER OF Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1980, c.148;

— and —

IN THE MATTER OF an undertaking of the Regional Municipality of Halton to provide facilities for the purpose of receiving, dumping and disposing of waste as required by section 137 of the REGIONAL MUNICIPALITY OF HALTON ACT, R.S.O. 1980, c.436, as amended, by acquiring the land for, constructing, operating and maintaining a landfill to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton.

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NETHERCUT & COMPANY LTD.

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I N D E X

Witnesses

Page No.

1 CRUTCHER, Anthony J. (resumed)

2 PETRIE, John M. (resumed)

3 Cross-examination by Mr. Hodgson 28404

4

5

6

E X H I B I T S

7

No. Description Page No.

8

H-676 Pump Test Data 28404

9

10 H-677 Report entitled "Bayview
Landfill/Indian Creek
Contamination Investigation" 28405

11

12 H-678 Report entitled "Bayview Park 28411
Landfill Site Leachate Discharge
Investigation Phase I" by Dillon
and Gartner Lee

13

14 H-679 Plan entitled "Total Land 28471
Requirements, Bayview Landfill
Site" dated January 9, 1986

15

16 H-680 Resolution of City of 28480
Burlington, dated July 22,
1985 (#SWM-69-85-1)

17

18 H-681 Report entitled "Conceptual 28486
Design Report Leachate
Collection System and Buffer
Land Requirements Bayview
Landfill Site City of
Burlington" dated January 1986

19

20

21

22 H-682 Report entitled "Detailed 28506
Design Report Leachate
Collection System & Surface
Drainage Improvements Bayview
Landfill Site City of
Burlington" dated June, 1986

23

24

25

25 H-683 Chart - Toluene 28514



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E X H I B I T S

(ii)

<u>No.</u>	<u>Description</u>	<u>Page No.</u>
1	H-684 Document entitled "Hydraulic Head Measurements Corrected for Differing Density"	28533
2		
3	H-685 Chart - Measured Potentiometric Levels of Cross-Section A-A	28545
4		
5	H-686 Chart - Potentiometric Pressures Corrected for Water Density on Cross-Section A-A	28545
6		
7	H-687 Chart - Potentiometric Levels Measured on Cross-Section B-B	28546
8		
9	H-688 Chart - Potentiometric Pressures Corrected for Water Density on Cross-Section B-B	28546
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

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28404

4

5

6

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8

H-676

Pump Test Data

28404

9

H-677

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28405

10

11

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Investigation Phase I" by Dillon
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28411

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14

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28471

15

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6		
7	H-687 Chart - Potentiometric Levels Measured on Cross-Section B-B	28546
8		
9	H-688 Chart - Potentiometric Pressures Corrected for Water Density on Cross-Section B-B	28546
10		
11		
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19 S.O. 1983, c.1, as amended; in connection with site
20 plan control of the sanitary landfill site;
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25 Affairs, on a request by the Regional Municipality of
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BEFORE: H. H. Lancaster, Q.C. - Chairman

Dr. D.J. Kingham - Member



Nethercut & Co. Ltd.

Toronto, Ontario

Hearing conducted at The Oakville
Granary Commercial Centre, 105 Robinson
Street, Oakville, Ontario, on Wednesday,
April 6, 1988

VOLUME 118

APPEARANCES:

T.R. Lederer and
H.D. Hodgson

for the Regional
Municipality of Halton
(Proponent)

J.R. Tidball

for the Ministry of the
Environment

T. Vigod
J.F. Castrilli

for the West Burlington
Citizens Group

D. Estrin,
F.E. Leitch and
H. Dahme

for the Corporation of the
Town of Milton

S.R. Garrod and
A. Nurvo

for the Milton Area Citizens
Coalition and several
affected Milton area
landowners

R.B. Tuer, Q.C.
E.A. Cronk,
F. Perrier and
L. J. Griffiths

for National Sewer Pipe
Limited

L.F. Longo

for Azova Investments
Limited

M.J. McQuaid, Q.C.
and C.J. Tzekas

for the City of Burlington

C. Mansfield

for the Ministry of Natural
Resources

P. Renaud

for Cumis Limited



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APPEARANCES (Cont'd):

1		
2	C. Stevenson	for Framgard Holdings,
3	P. Hancock	Fosseri Investments
4		Limited, Seriphos
5		Investments Limited and
6		Topic Investments
7		
8	J.H. Olah	for the Halton Region
9		Conservation Authority
10		
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Toronto, Ontario
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Per: C.F. Nethercut, CVR



Oakville, Ontario
April 6, 1988

1 --- Upon Commencing at 9:30

2 MR. LANCASTER: Please be seated.

3 ANTHONY J. CRUTCHER, (resumed):

4 JOHN M. PETRIE, (resumed):

5 MR. HODGSON: In the continuing saga of
6 the pump tests at Site F, we have the data on those
7 pump tests which is now available to be distributed.

8 MR. LANCASTER: We will mark that H-676.

9 --- EXHIBIT NO. H-676: Pump Test Data

10 MR. HODGSON: Mr. Crutcher has been kind
11 enough to make available sets of photographs of some of
12 these large exhibits. They are photographs of Exhibits
13 H-661, 659, 663, 662, H-657, H-645, M-437-D5 and
14 H-665. I don't know whether there is any need to mark
15 these separately or if they could be literally
16 photographic reproductions of exhibits.

17 MR. LANCASTER: I think they are just
18 for convenience as we have the exhibits.

19 MR. HODGSON: Perhaps by the end of the
20 hearing somebody may mark something on one of them, but
21 we will have to deal with that problem as we go along.
22 I have here two sets of those photographs.

23 MR. LANCASTER: Thank you. There appear
24 to be eight in all.

25 CROSS-EXAMINATION BY MR. HODGSON, (continued):



1 Q. Now then, Mr. Crutcher, I think we
2 have already discussed that we are going to talk this
3 morning about remedial alternatives for the Bayview
4 Park landfill leachate controls, and I'm sorry but as
5 usual I didn't write down the exhibit number.

6 MR. LANCASTER: The one you filed last
7 night was H-675, the remedial alternatives and the pump
8 test data is 676.

9 MR. HODGSON: Q. I thought,
10 Mr. Crutcher, that it might be useful if we talked
11 about this exhibit in context and as part of that
12 context I thought that we should distribute for
13 everyone's use at the same time a copy of another
14 report prepared by Conestoga-Rovers at exactly the same
15 time, July of 1985, and again this is a document signed
16 by you, Bayview Landfill/Indian Creek Contamination
17 Investigation. Is that a copy of your report?

18 MR. CRUTCHER: A. It is.

19 MR. LANCASTER: Six-seven-seven.

20 --- EXHIBIT NO. H-677: Report entitled "Bayview
21 Landfill/Indian Creek
Contamination Investigation"

22 MR. HODGSON: Q. Mr. Crutcher, the
23 Bayview Park Landfill/Indian Creek Contamination
24 Investigation has attached to it a letter from the
25 Ministry of the Environment, a letter from Mr. G.B.



1 Nelson, District Officer, Halton Peel, addressed to the
2 Corporation of the City of Burlington, to the attention
3 of the Chief Administrative Officer.

4 MR. CRUTCHER: A. Correct.

5 Q. The letter is dated the 24th of
6 May, 1985.

7 MR. LANCASTER: The last exhibit?

8 MR. HODGSON: I am looking at the last
9 exhibit, H-676.

10 MR. ESTRIN: It was after that.

11 MR. HODGSON: Exhibit H-676, Bayview
12 Park Landfill/Indian Creek Contamination
13 Investigation.

14 MR. CRUTCHER: I believe that that's
15 677.

16 MR. HODGSON: What did I miss?

17 MR. LANCASTER: The pumping test data.
18 I'm looking for that particular letter.

19 MR. ESTRIN: It's at the back of my
20 copy.

21 MR. LANCASTER: I see, Appendix A.

22 MR. HODGSON: Q. I take it,
23 Mr. Crutcher, that the work you did for the City was in
24 response to the City's response to this letter from the
25 Ministry of the Environment?



1 MR. CRUTCHER: A. That is correct. Our
2 involvement commenced essentially at this time.

3 Q. Turning to the second page of that
4 letter, the last page of the exhibit, H-677, and at the
5 top of the page we see the following:

6 "Correspondence from Mr. K. Hogg, P.
7 Eng., District Officer, Municipal
8 private abatement section to yourself,
9 dated March 22, 1982 and previous
10 correspondence should clearly indicate
11 to you the concern the Ministry has with
12 respect to these problems and the many
13 recommendations that we have made with
14 respect to their remedy."

15 That paragraph references a concern, does it not, with
16 contamination from the Bayview Landfill Site?

17 A. It does.

18 Q. It expresses the fact that the
19 Ministry raised this subject with the City as early as
20 1982?

21 A. Yes.

22 Q. Could I ask you in Exhibit H-677
23 to turn to page 3 of that document, the pages as they
24 are numbered by you, and there are a number of Roman
25 Numeral pages and then they start with page 1 and on



1 page 3 there is a paragraph 2.0 "WORK UNDERTAKEN"?

2 A. Yes.

3 Q. The first item is:

4 "... - review and interpretation of all
5 available MOE sampling data with regard
6 to the Bayview Landfill and Indian
7 Creek..."

8 A. Yes.

9 Q. The next item is:

10 "... - review of relevant City files for
11 information and collection and
12 interpretation of City data on the
13 Bayview Site ..."

14 A. Yes.

15 Q. I take it that the City provided
16 you or gave you an opportunity to look through its
17 files and from those files you were able to discern
18 what probably was a substantial quantity of information
19 relating to possible contamination from the Bayview
20 Park Landfill?

21 A. I don't recall there being a
22 substantial amount of information, but from memory I
23 recall the City provided us with a package of
24 information which they said they obtained from the
25 files.



1 Q. I want to show you, Mr. Crutcher,
2 a letter dated the 21st of July, 1980 to the City of
3 Burlington from Mr. Giffen, District Officer in the
4 Ministry of the Environment, and that letter attaches a
5 report from a Mr. J.S. Dulny and it is dated -- I
6 thought it was dated -- the 27th of June, 1980. Have
7 you seen Mr. Dulny's report before?

8 A. I have seen reports from Mr. Dulny
9 but whether it was specifically this one I don't
10 recall, but let me quickly scan it. Yes, I believe I
11 have seen this before.

12 MR. HODGSON: I did not intend to put
13 this into evidence but I wanted to read for the record
14 the first paragraph of this report where it reads ...

15 Q. Perhaps you could read it,
16 Mr. Crutcher.

17 MR. CRUTCHER: A. "Due to the concerns
18 expressed in the Provincial Parliament
19 in the summer of 1978 pertaining to
20 organic chlorine levels, a comprehensive
21 sampling program was initiated at the
22 Bayview Park Recreational Area (formerly
23 the Burlington Landfill Site). The
24 purpose of the program was to monitor
25 specific constituents of leachate



1 migrating from the site. Particular
2 attention was paid to polychlorinated
3 biphenols (PCB's) and organo-chlorine
4 pesticides."

5 Q. Would it be fair, Mr. Crutcher, to
6 say that concerns about contamination from the Bayview
7 Park Landfill go back at least to 1978?

8 A. It appears so and that predates
9 our involvement, but it appears that way.

10 Q. Your involvement began in
11 approximately 1985, did it not?

12 A. That is correct.

13 Q. I don't propose to review in
14 enormous detail all of the history of this, but I
15 notice also on page 4 of Exhibit H-677 that among the
16 documents you reviewed in this description of the work
17 undertaken was a:

18 "- Review of the 1981 Dillon, Gartner
19 Lee Phase I report prepared for the City
20 of Burlington, outlining remediation
21 measures for leachate springs on the
22 Bayview Park Site."

23 A. We did.

24 Q. I want to show you a copy of that
25 report and I want to show you a copy of a report and



1 ask you if this is the Dillon report which you reviewed
2 at that time.

3 A. It appears to be.

4 Q. You will notice it is not dated
5 1981 but 1982 and I don't think anything turns on that
6 but I just want to satisfy myself that I have a copy of
7 the report that contains the substance of the material
8 you reviewed.

9 A. Yes. I think there was a draft of
10 that in '81 and I think we may have reviewed the draft
11 and then the Ministry provided some comments and they
12 finalized it.

13 Q. This is a copy of that so I might
14 have my copy back and I will give you these two copies.

15 A. Thank you.

16 MR. HODGSON: Perhaps this could be the
17 next exhibit.

18 MR. LANCASTER: H-678.

19 --- EXHIBIT NO. H-678: Report entitled "Bayview Park
20 Landfill Site Leachate
21 Discharge Investigation Phase
I" by Dillon and Gartner Lee

22 MR. HODGSON: Q. Now, Mr. Crutcher,
23 could we turn -- I want to review briefly a couple of
24 issues in this document. Would you agree with me that
25 what Dillon and Gartner Lee were doing, and you will
see the first report is from Dillon and the second



1 report in this document H-678 is from Gartner Lee?

2 MR. CRUTCHER: A. Excuse me for just
3 one second. I have the original to that document and I
4 believe it is missing one of the figures.

5 Q. The copy is missing a figure?

6 A. Yes.

7 Q. Can you help us with what figure
8 it is?

9 A. It is Figure 3 and it may be here
10 but I can't seem to find it. There is Figure 2 and
11 then Figure 3.

12 Q. I have never seen Figure 3. The
13 copy is indeed missing a page and if I can borrow your
14 copy over the break I will have that page photographed
15 and we will insert it in the document so we have a
16 complete document.

17 MR. LANCASTER: Which page?

18 MR. HODGSON: Figure 3 from H-678 is
19 just not there and the copy I have does not have it and
20 all your copies were made from the one I had.

21 DR. KINGHAM: That would be the figure
22 which follows the aerial photograph?

23 MR. CRUTCHER: It follows Figure 2 and
24 precedes the aerial photograph.

25 MR. HODGSON: It precedes the aerial



1 photograph.

2 Q. This second document from Gartner
3 Lee I take it is a document which you reviewed in July
4 -- June and July of 1985?

5 MR. CRUTCHER: A. That is correct.

6 Q. Would I be correct in assuming
7 that what Gartner Lee were trying to do was identify
8 the extent of contaminant migration, the nature and
9 extent of contaminant migration from the Bayview Park
10 Landfill Site?

11 A. I believe it was primarily
12 oriented to the surface waters as per our
13 investigation, but to some extent, yes.

14 Q. Their client at the time was the
15 City of Burlington?

16 A. The client was M.M. Dillon who was
17 the prime consultant retained by the City of
18 Burlington.

19 Q. This was a report directly or
20 indirectly prepared for the City of Burlington?

21 A. Correct.

22 Q. Presumably in response to concerns
23 raised by the Ministry of the Environment?

24 A. I believe so, yes.

25 Q. There is an indication on page 4



1 and I want to get roughly the parameters of the problem
2 that Gartner Lee thought they perceived, but on page 4
3 at the top of the page, the first paragraph, the last
4 sentence reads:

5 "Also, there is evidence that the plume
6 may be around 100 feet deep."

7 A. Yes.

8 Q. In fact the figure you just showed
9 me shows a cross-sectional drawing of a plume, does it
10 not?

11 A. It does.

12 Q. That would supplement that
13 particular paragraph?

14 A. Yes. As a matter of fact this is
15 referred to just above that line.

16 Q. Figure 3. Over on page 5 what is
17 really the second full paragraph reads:

18 "From preliminary water budget
19 calculations, ..."

20 A. Yes.

21 Q. Perhaps we could read this
22 together because it has some importance later on:

23 "From preliminary water budget
24 calculations, surface water infiltration
25 into the refuse is about 6.5 inches on



1 an average annual basis, assuming a
2 vegetated, clay cover over the waste.
3 Thus the rate of infiltration averages
4 about 12 gal/min over the 40 acres of
5 landfill. Leachate springs account for
6 about 5 gal/min. Exfiltration through
7 the base of the landfill, assuming
8 equilibrium conditions, is then about 7
9 gal/min or 10,000 gal/day, on an average
10 annual basis. Therefore about half the
11 ground water base flow is generated from
12 the landfill."

13 Just working with those numbers, they take an
14 infiltration rate of 6.5 inches over the whole landfill
15 which I multiplied this morning and got 165.1
16 millimetres.

17 A. I just did exactly the same thing
18 and got the same number.

19 Q. You and I are clearly working with
20 similar calculators. Then, it was Gartner Lee's view
21 back in 1981 or 1982 when this report was prepared that
22 of that amount five gallons per minute was coming out
23 of leachate seeps in the landfill?

24 A. Yes.

25 Q. And seven gallons per minute were



1 exfiltrating out the bottom of the landfill.

2 A. That was the outcome of their
3 infiltration, of the 12 inches.

4 Q. If 165.1 millimetres per year
5 works out to 12 gallons per minute, then we can take
6 the proportions of 12 gallons of five and seven and
7 work those out in millimetres per annum or equivalent
8 millimetres per annum of exfiltration?

9 A. Yes.

10 Q. In fact I carried out that
11 exercise and I wonder if you would agree with me that
12 five gallons per minute works out to 68.8 millimetres
13 and seven gallons per minute works out to 96.3
14 millimetres.

15 A. Ninety-six point ...

16 Q. ... three per annum.

17 A. I could do the calculations but
18 they appear to be correct proportionately.

19 Q. Those two should add up to
20 approximately 165.1 and I didn't do that check but it
21 might even work out. Just so we understand, Gartner
22 Lee we have already seen thought that the contamination
23 could be 100 feet deep which converts to 30.5 metres;
24 right?

25 A. Right.



1 Q. If you would now turn, please, to
2 page 8 we will see that Gartner Lee proposed various
3 remedial measures and the first remedial measure they
4 propose -- let's read it together:

5 "The following sections of the report
6 describe conceptually various remedial
7 measures to control leachate movement
8 off the site and to prevent surface
9 water contamination. In summary,
10 contaminant movement in the ground water
11 southeast of the site could be
12 controlled by purge wells, and southwest
13 of the site by an interceptor drain.
14 Leachate springs at the southeast end of
15 the landfill could be intercepted by a
16 toe-drain and sump. Although no
17 leachate springs were noted along the
18 eastern periphery of the site, a
19 contingency toe-drain system could be
20 considered if a problem developed in the
21 future."

22 And then it goes on to discuss purge wells and I wonder
23 if we could turn over to page 9, the first full
24 paragraph:

25 "A system of purge wells would be



1 required to collect contaminated ground
2 water from the rock and to prevent off-
3 site movement of contaminants. For
4 preliminary design purposes, the wells
5 may be located near the southeast end of
6 the landfill between King Road and the
7 southwestern edge of the site."

8 Have you got a copy of a plan view of these landfills
9 anywhere there? Perhaps just one of the aerial photos
10 would do. Would you just indicate for the Board what
11 your understanding is of Gartner Lee's proposal that
12 they put in a system of purge wells near the southeast
13 end of the landfill between King Road and the
14 southwestern edge of the site?

15 A. I believe they are talking along
16 the southern boundary.

17 Q. What we call the southern
18 boundary?

19 A. Yes.

20 Q. "This distance is about 1300 feet.
21 Assume a well spacing of 100 feet and a
22 bottom elevation of 310 f.a.s.l. in
23 order to obtain adequate drawdown
24 between wells."

25 F.a.s.l. is feet above sea level?



1 A. Yes.

2 Q. If we multiply that by 0.3048 we
3 will get metres above sea level; is that right? How do
4 you convert feet above sea level to metres above sea
5 level and don't you multiply it by 0.3048?

6 A. I divide by 3.281 which is the
7 inverse of that.

8 Q. I may have done it wrong.

9 A. I have 94.5.

10 Q. I got the same answer. Would you
11 get out, please, an exhibit Mr. Petrie and I have been
12 working with, a cross-section from the Geocon report?
13 Could you indicate for the Board what is the height
14 above sea level of the rock at the base of the Bayview
15 Landfill Site, at the southern toe of the Bayview
16 Landfill?

17 A. Approximately 140.

18 Q. I accept and appreciate,
19 Mr. Petrie, that I'm asking you to interpret someone
20 else's document ...

21 A. Mr. Crutcher.

22 Q. Mr. Crutcher, sorry. Is it fair
23 to assume that Gartner Lee were proposing to drill
24 their purge wells down to the level of 94.5 metres?
25 Where would 94.5 metres fall on this cross-section?



1 A. It would be approximately at this
2 location (indicating).

3 Q. Could you, Mr. Petrie --
4 Mr. Crutcher -- we have run out of colours so what have
5 we got?

6 A. How about orange?

7 Q. Brown. I have a brown. Do you
8 have a brown?

9 A. No, I don't.

10 Q. Would you indicate with a brown
11 circle with an X in it the approximate elevation of
12 94.5 metres beneath the toe of the Bayview Landfill
13 Site?

14 A. Would you like it placed right
15 below the toe as well?

16 Q. I assume it would have been fair
17 to say these would have been downgradient slightly from
18 the landfill.

19 A. I have a map that was within the
20 original report which locates them and it appears they
21 had two options and one was within the refuse itself
22 and one was downgradient of the refuse.

23 Q. Is it downgradient very much from
24 the refuse? Is it downgradient very far from the
25 refuse?



1 A. No, it is essentially at the toe.

2 Q. "Essentially at the toe." Would
3 you for our purposes mind locating that X existentially
4 below the toe of the landfill? Gartner Lee:

5 "Assume a well spacing of 100 feet and a
6 bottom elevation of 310 f.a.s.l. in
7 order to obtain adequate drawdown
8 between wells."

9 And then they go on to say they were going to use six-
10 inch wells and they would pump each well at a gallon
11 per minute to give a total discharge of 12 gallons per
12 minute. That is one of the proposals Gartner Lee have
13 and they also talked about an interceptor drain, a toe
14 drain with a sump, a contingency toe drain, et cetera,
15 et cetera; is that fair?

16 A. Yes.

17 Q. In fact we will hear more about
18 those kinds of remedies later I believe. Now,
19 Mr. Crutcher, can you advise, when you took on the job
20 of dealing with the Bayview Landfill Site, was it in
21 June of 1985?

22 A. Yes, I think the latter part of
23 June.

24 Q. To your knowledge were any of the
25 works that were discussed in Exhibit H-678, the Dillon,



1 Gartner Lee report, were any of those in place when you
2 took on the job?

3 A. No, they were not.

4 Q. Do you recall, Mr. Crutcher, that
5 you and I were participants along with Mr. Tidball and
6 Mr. Parsons and others at the hearing into the
7 expansion of the existing Burlington Landfill Site in
8 1984?

9 A. Yes.

10 Q. In fact you were also a
11 participant in a number of discussions between the
12 Region and the City that preceded that hearing?

13 A. Yes, I was.

14 Q. Were you at the hearing the day
15 that Mr. Boggs gave evidence on the City's position?

16 A. I don't recall that, but I believe
17 I was at the hearing the whole time so I assume if he
18 gave evidence I was there but I don't recall that.

19 Q. Can you confirm that in 1984 the
20 City as part of its quid pro quo agreed to a
21 continuation of the Burlington Landfill Site and sought
22 the material assistance of the Region of Halton in
23 dealing with the Bayview Landfill Site? Perhaps I
24 could refresh your memory, Mr. Crutcher, by showing you
25 a copy of the reasons for decision in that hearing by



1 Mr. Eisen and Mr. Jeffery, the Environmental Assessment
2 Board, and at page 55 there is a summary of the
3 evidence of Michael Boggs who you would agree was the
4 CAO for the City of Burlington at the time?

5 A. Yes.

6 Q. We find on page 56 the following,
7 and this is the Board's summary of Mr. Boggs' evidence:

8 "Mr. Boggs is not satisfied with the
9 Region's response with regard to the
10 problems at Bayview Park and with its
11 response to the matter of noise
12 attenuation. As for the former, it is
13 the City's contention that the Region
14 must share in the responsibility of
15 cleaning up leachate migrations from the
16 site."

17 Is it fair then to say that the City's position at that
18 hearing was that the Region should help out with the
19 Bayview Landfill Site?

20 A. I only have vague recollections of
21 that and reading that it would appear so, but I don't
22 really recall anything in detail on that matter.
23 Mr. Boggs worked independently in dealing with that.

24 Q. Do you recall during meetings and
25 discussions around that time that took place between



1 the Region and the City, discussions which you have
2 already told us you were a participant to, that this
3 was a matter that was being discussed and the City was
4 asking the Region to assist the City in dealing with
5 the problem of the Bayview Landfill Site?

6 A. Like I say, I only have vague
7 recollections and I couldn't give you any details on
8 that and I was not specifically involved. I may have
9 been there, but I don't really recall the details.

10 Q. Do you recall the subject was
11 discussed?

12 A. Now you bring it up it sounds
13 somewhat familiar and that's about the best I can give
14 you on that.

15 Q. And would it be fair to say,
16 Mr. Crutcher, that when you were retained, first
17 retained by the City, and I think you told us that was
18 in early 1984?

19 A. Some time in 1984.

20 Q. You were retained for two purposes
21 and the first purpose was to review the Regions'
22 environmental assessment process?

23 A. That is correct.

24 Q. The second purpose was to assist
25 the City's counsel during his participation, during the



1 City's participation in the hearing before the
2 Environmental Assessment Board in May and June of 1984?

3 A. It was initially to review and
4 pass an opinion and secondly to assist counsel.

5 Q. I mean you were asked for your
6 expert advice on that expansion?

7 A. That is correct.

8 Q. In fact you weren't retained to
9 address any problems associated with the Bayview
10 Landfill Site?

11 A. No, and I knew very little about
12 Bayview at that time.

13 Q. You were not retained to address
14 those problems until June of 1985?

15 A. That is correct.

16 Q. Then, the next step in this,
17 Mr. Crutcher, comes with the release to the public in
18 early 1985 of first the draft and then the final Stage
19 2C reports in this Environmental Assessment, and do you
20 recall receiving first of all the draft and then the
21 final technical reports from Trow/Hydrology Consultants
22 in this Environmental Assessment?

23 A. I do.

24 Q. This particular report is H-38 in
25 this proceeding.



1 A. That is what it says.

2 Q. Do you have a copy of H-38? You
3 can work with mine if you don't.

4 A. The response document?

5 Q. The hydrogeological report ...

6 A. I don't have it.

7 Q. ... produced by the Region. I
8 think we can work with my document. What I am showing
9 you on page 38 is following page 60 we have a number of
10 maps and one of the maps is a site plan area.

11 A. It is.

12 Q. You will see that on that site
13 plan area at the back of the document following page 60
14 and by eyeballing it it is 85 or 90 per cent of the way
15 through the document behind page 60 and if you thumb
16 the maps it is the fifth map after page 60.

17 DR. KINGHAM: It's easier to find page
18 61 than page 60.

19 MR. HODGSON: If you have found page 61
20 you can do it the other way because it is the page
21 preceding page 61. I never do it an easy way if I can
22 find a complicated way.

23 DR. KINGHAM: A map called "Probable
24 Candidate Site F."

25 MR. HODGSON: Yes, site plan area.



1 Q. Looking at this would you agree
2 with me that the proposed site plan area included the
3 placing of garbage in that area south of the Bayview
4 Landfill Site between the Bayview Landfill Site and
5 Highway 403 and...

6 MR. CRUTCHER: A. Yes.

7 Q. ... in fact most of that area is
8 included with garbage and only a small portion is
9 included in the buffer zone?

10 A. That is correct.

11 Q. Do you recall, Mr. Crutcher, that
12 among the issues that were discussed in this report was
13 some statements made about the Bayview Landfill Site?
14 First I am showing you, and I apologize because I am
15 now on page 81 of the report. Now we are dealing with
16 Site F and this is a section entitled "Existing
17 Constraints to Site Development" and we have at the
18 bottom of page 81 on the left-hand side under "Factor,"
19 "Surface Drainage" and it says "Consideration":

20 "Leachate and sediment contamination of
21 surface water."

22 And then "Comment":

23 "Complex surface drainage pattern
24 including leachate springs from
25 abandoned Bayview Site."



1 So, one of the factors that were being considered as a
2 constraint was the issue of leachate coming from the
3 Bayview Landfill Site?

4 A. Yes.

5 Q. Then over the page on page 82 we
6 have "Existing Constraints to Site Development" again,
7 "Complexity to engineer site" as one of the factors and
8 "Consideration":

9 "Reliability of engineered systems."

10 And under the "Comments":

11 "Complex leachate drains may be
12 required."

13 And then the comment:

14 "Seepage from abandoned Bayview Landfill
15 Site is to be collected."

16 And do you see that?

17 A. I do.

18 Q. Would you agree with me that if
19 the site was constructed as it was conceptualized on
20 the map you previously looked at, that indeed there
21 would be some interception of leachate emanating from
22 the Bayview Landfill Site?

23 A. That would be a prerequisite and
24 as constructed there wouldn't be much choice.

25 Q. On page 89 we see this issue



1 raised again and we have "Potential Impacts of
2 Engineered Site Development" and we have "Surface Water
3 Quality" and it reads:

4 "Because the leachate collection system
5 will pick up leachate springs from the
6 abandoned Bayview Landfill Site and
7 direct them to sewage treatment
8 facilities, there will be an improvement
9 in the surface water quality."

10 And the impact level associated with that is
11 "Beneficial."

12 A. Yes, I note that.

13 Q. Going back to the portion of the
14 summary of the evidence from the 1984 expansion hearing
15 I read to you, would you agree with me, Mr. Crutcher,
16 that what we have here is a game we all played as
17 children called "Musical Chairs"? In 1984 the City was
18 asking the Region "Help us out with the Bayview
19 Landfill Site" and the Region was saying "No" and in
20 1985 ...

21 MR. McQUAID: That is not in evidence.

22 MR. HODGSON: I read it out of the
23 Board's report that it was 1984. Do you dispute it?

24 Q. Then we have in 1985 the Region's
25 consultants putting out a report saying "If we build a



1 landfill at Site F we will solve the problem of the
2 Bayview leachate." Is that fair?

3 MR. CRUTCHER: A. I believe they were
4 referring to the leachate seepage and in fact as I
5 indicated that would be a natural outcome because they
6 were placing the landfill directly below that and so
7 you wouldn't have a choice.

8 Q. That would deal with the problem
9 of Bayview?

10 A. With the leachate seepage at the
11 surface.

12 Q. You will recall the draft reports,
13 or the draft of H-38 or the final report of H-38 came
14 out in June, 1985, the date on the front page?

15 A. Yes.

16 Q. The draft report preceded it by
17 some number of months?

18 A. It was out in January or February
19 of that year.

20 Q. The draft report would have
21 contained very likely statements of a similar nature
22 about the relationship between the Bayview leachate and
23 the construction of a site at the Burlington Landfill
24 Site?

25 A. I believe so.



1 Q. And then would it be fair to say,
2 Mr. Crutcher, that in and about this time, the very
3 time the Region was putting out reports by its
4 consultants saying that a regional landfill site at
5 Site F would solve the problem at Bayview, the Ministry
6 of the Environment got back into the question of what
7 we will do about Bayview and wrote the letter we found
8 on the back page of H-677?

9 A. I believe it had something to do
10 with the health of the individual on the timing, but in
11 1982 the Ministry of the Environment was quite active
12 on reviewing the situation at Bayview and again I
13 wasn't involved but I did inquire as to why there was a
14 time lag between '82 and '85 and it was something to do
15 with the health of the individual and they lost some
16 continuity and there were miscommunications between the
17 Ministry and the City and that accounted for a lot of
18 the timing. I do not know if the Ministry's letter of
19 1985 was as a result of any of the Halton EA work or
20 not.

21 Q. The point is that the whole issue
22 was raised again by the Ministry of the Environment in
23 May of 1985?

24 A. Yes, they raised it again it seems
25 to me.



1 Q. That resulted in your retainer to
2 deal with this problem or to address this problem?

3 A. That is correct.

4 Q. By early July of 1985 you had
5 produced both Exhibit H-677, the contamination
6 investigation, and H-675, the remedial alternatives?

7 A. You will note the timing is very
8 quick on our preparation of those documents as the City
9 indicated to us it was a very serious matter and they
10 wanted us to move as expeditiously as we could and so
11 in fact we got on the project immediately and reviewed
12 as many of the documents as we could and passed our
13 preliminary opinion on what was happening at the site.

14 Q. On page 9 of H-677 ...

15 A. Which one is that?

16 Q. The contamination investigation.

17 A. Yes.

18 Q. You indicate in the second full
19 paragraph:

20 "A total of six leachate seep locations
21 were located predominantly on the
22 western and southern faces of the closed
23 landfill."

24 A. Yes.

25 Q. At the top of page 11:



1 "In general these leachate seep analyses
2 confirm the strength of the leachate as
3 detailed by the MOE analyses."

4 And then we have facing that page the "Leachate Seep
5 Water Analysis Results" and would you agree that they
6 suggest those leachate seeps had leachate in them?

7 A. They indicate they are
8 contaminated, yes.

9 Q. And that leachate was making its
10 way to the creek. Is that right?

11 A. The headwaters of Indian Creek or
12 portions of it are essentially the Bayview Landfill so,
13 yes, they were contributing to the headwaters.

14 Q. The headwaters of Indian Creek at
15 this time were the Bayview Landfill Site?

16 A. There is a stream adjacent to
17 Bayview or swale, a drainage system that goes farther
18 north than Bayview or a portion of it is the
19 headwaters.

20 Q. Leachate constituted a portion of
21 the headwaters of Indian Creek?

22 A. A portion of it.

23 Q. Indian Creek flows down through
24 Aldershot and makes its way to Lake Ontario?

25 A. It does.



1 Q. You concluded, did you not, in
2 this study that this was a problem and the problem
3 deserved to be addressed?

4 A. We did.

5 Q. Let's go then to Exhibit H-675.
6 Could I ask you to turn -- there is a page between page
7 22 and 24 or 23 rather of this exhibit, H-675 the
8 remedial alternatives, and it's a kind of summary of
9 some of the information contained in this report, is it
10 not? I wonder if we could agree this could be marked
11 as page 22A so we can turn it up with ease.

12 MR. LANCASTER: If you would just give
13 us a moment to find it.

14 MR. HODGSON: The second-last page from
15 the back.

16 MR. LANCASTER: What did you want to
17 number it?

18 MR. HODGSON: I thought we could number
19 it page 22A.

20 MR. LANCASTER: All right.

21 DR. KINGHAM: We should be grateful it's
22 not the second-last page from the front.

23 MR. HODGSON: I'm sure by the time we
24 get through this hearing we will have a document that
25 looks like that as well.



1 Q. Now, Mr. Crutcher, I didn't
2 understand the distinction between Option A and Option
3 B and when I read the text and I didn't understand that
4 until I read this table, 8.1. Would you agree with me
5 that Option A in effect is nine alternatives listed in
6 the left-hand column and Option B is each one of those
7 nine alternatives with an add-on? Is that fair?

8 MR. CRUTCHER: A. Adding additional
9 downgradient lands, yes.

10 Q. Just looking at four of these
11 options if we could, and they are very similar, but in
12 both options 6 and 7 you suggest the estimated
13 efficiency, the middle column will be plus or minus 75
14 per cent?

15 A. That is correct.

16 Q. Those alternatives, 7 and 8, if
17 you have the add-on of some downgradient land will have
18 efficiencies of greater than 80 per cent?

19 A. Yes, that is what we indicate.

20 Q. Then if we go to alternatives 8
21 and 9 we see that the estimated efficiencies for these
22 alternatives alone are plus or minus 90 per cent?

23 A. That is correct.

24 Q. If we add another 90 acres to the
25 whole situation we get a solution which gives us



1 greater than 95 per cent?

2 A. That is correct.

3 Q. Let's go through the document and
4 see if we can understand how it is that you arrive at
5 those conclusions and what it is. First of all looking
6 at page 2, Mr. Crutcher, but is it fair that out of
7 hand you dismissed Dillon's proposal to put in purge
8 wells at a level some 30 or 40 metres -- excuse me, but
9 how many metres below the toe of the Burlington
10 Landfill Site do we find the purge wells that Dillon
11 were proposing?

12 A. The toe is at 140 which I
13 indicated so it's 46.5.

14 Q. Forty-six point five. So, it was
15 the view of CRA that the purge wells were not an
16 appropriate option?

17 A. We had reviewed -- we were
18 reviewing work done by others and I believe we were
19 reviewing, and it says:

20 "CRA would concur with the MOE comments
21 that the use of purge wells is not
22 recommended at this location..."

23 And we were reviewing their comments and I don't recall
24 specifically those comments at the moment.

25 DR. KINGHAM: Could I ask if those



1 comments are part of this exhibit or one of these
2 others we got this morning or is that a reference to
3 oral comments?

4 MR. CRUTCHER: I believe it's written
5 comments and again I am going from memory, but I think
6 when we referred to a 1981 Dillon document I think that
7 was a draft given to the Ministry and then the Ministry
8 commented on it and then they finalized their report in
9 1982.

10 DR. KINGHAM: It's not in these
11 documents?

12 MR. CRUTCHER: I don't believe so. I
13 believe when we prepared this document I reviewed that
14 but I have not seen it since that time that I can
15 recall.

16 MR. HODGSON: Q. On page 4 we have
17 "PROPOSED ALTERNATIVES" and we have nine alternatives
18 which we can now understand from the Table 8.1 at the
19 back are Option A alternatives. Is that fair?

20 MR. CRUTCHER: A. You could actually
21 add that.

22 Q. It would probably assist everyone
23 in the reading of this document if before the words "a
24 number of alternatives" we simply put in a new title
25 which read Option A.



1 A. Yes.

2 MR. ESTRIN: Where are you?

3 MR. HODGSON: I'm on page 4.

4 Q. We will come back in a minute to
5 talk about these options because they are rather
6 cryptically discussed here and they are more fully
7 discussed elsewhere and I think it would be fairer to
8 look at them elsewhere but let's look at Option B:

9 "Option B uses land downgradient of the
10 Bayview Site for Buffer zone,
11 monitoring, attenuation, and
12 assimilation capacity for leachate
13 treatment. This option could be used in
14 conjunction with any of the above listed
15 alternatives.

16 Each alternative as listed has been
17 reviewed for capital cost, advantages,
18 disadvantages, anticipated efficiency in
19 controlling all leachate contamination,
20 timing, and operational costs.

21 The remedial concepts as presented in
22 the 1982 Dillon report have not been
23 included in CRA alternatives. However
24 components of the Dillon concepts have
25 been included in the alternatives as



1 presented."

2 You are saying there, Mr. Crutcher, that you borrowed
3 some ideas from the Dillon report and that is a fair
4 activity in engineering.

5 A. The Dillon report had the Dillon
6 and Gartner Lee and we used the factual information as
7 some of the bases and came up with alternatives and in
8 fact our alternatives are very similar.

9 Q. To go back to page 4:
10 "Option B uses land downgradient of the
11 Bayview Site for Buffer zone,
12 monitoring, attenuation, and
13 assimilation capacity for leachate
14 treatment."

15 If we flip back to Table 8.1 we can see the lands you
16 are talking about are 90 acres.

17 A. Correct.

18 Q. Could you move Exhibit M-437-D5 so
19 we can see the aerial photograph again? Could you
20 indicate for the Board, and maybe it would be
21 appropriate if you put it with a pen, but approximately
22 where those 90 acres were? I have a green one if you
23 want a green one.

24 A. I have a green one. The area we
25 were referring to is directly south of the Bayview Park



1 Landfill and down to the North Service Road. I have
2 highlighted that in a dotted green on Exhibit M-449 and
3 I think the 90 was approximate, we didn't exactly know
4 the actual number but it was something in that order.

5 Q. The 90 is the number you have
6 given on Table 8.1?

7 A. Yes.

8 Q. Let's go through Option A for a
9 second, the alternatives, alternative one is do nothing
10 and I don't think we need to discuss that. Alternative
11 2 was excavate and fill individual seeps.

12 A. Page 6?

13 Q. Page 6. Am I right that the
14 concept was that you were going to use a backhoe to dig
15 them out and put clay material over them?

16 A. That is correct.

17 Q. That would only have been -- that
18 would be like putting a bandaid on a dike, wouldn't it,
19 and it wouldn't stop very much from going through?

20 A. We felt it would have -- I think
21 if you refer to our efficiencies on page 22A, we said
22 it would have an estimated efficiency of zero to 40 per
23 cent so we didn't give it a particularly high rating
24 and your bandaid is probably a suitable analogy.

25 Q. Option 3 is individual



1 sumps/holding tanks. What was the concept of an
2 individual sump?

3 A. The ravines along the south of the
4 Bayview Park Landfill, there are a number of ravines
5 where the seepage was emanating from and we would
6 create an area where we could pump which would be the
7 sump area and pump it to a holding tank which would
8 subsequently be pumped out and taken to a sewage
9 treatment plant. That would eliminate the need to
10 construct forcemains and gravity sewers and such.

11 Q. And the fourth alternative was the
12 add-on of a forcemain?

13 A. Right.

14 Q. Alternative 5 is individual sumps
15 and a gravity sewer. Let's go now to alternative 6
16 which is a development out of alternative 3 because you
17 will have the individual sumps on the south side of the
18 landfill site and then you are proposing toe collection
19 systems on the west and east boundaries.

20 A. Correct.

21 Q. Just so we can jump ahead and get
22 this story straight in our minds, is alternative 6, or
23 alternative 7, I'm not sure which, but alternative 6 is
24 a forcemain and alternative 7 is a gravity flow sewer
25 but otherwise they are identical, are they not?



1 A. I think alternative 7 had the
2 connection going across the NSP property where No. 6
3 had it going down King Road.

4 Q. But the difference between 6 and 7
5 isn't how much leachate you collect but what you do
6 with the leachate once you have got it?

7 A. Yes.

8 Q. It's how much we collected I want
9 to focus on. Can we talk about alternatives 6 and 7
10 together and leaving out the distinction as to how you
11 get the leachate off-site? You were proposing the
12 individual sumps in the manner you have already
13 described; correct?

14 A. Yes.

15 Q. Along the south side?

16 A. Yes.

17 Q. In the valleys on the south side?

18 A. Yes.

19 Q. In fact, could you take down
20 M-437-D5 and draw for the Board what the south side of
21 the landfill site would look like in a kind of cross-
22 section if you were standing on Highway 403 and looking
23 north at the Bayview Landfill Site? It sort of
24 undulates, does it not?

25 A. Yes, it does.



1 Q. This doesn't have to be 100 per
2 cent, Mr. Petrie, just the concept would do --
3 Mr. Crutcher.

4 A. The concept would be an undulating
5 surface, and I don't know exactly how many, but we
6 would have a stream at the base of each of the valleys
7 and that stream would be connected to the landfill site
8 where some of the seepage was emanating.

9 Q. Now, Mr. Estrin has reminded me
10 that if we look in the Dillon -- in H-678 toward the
11 back, Figure 2, the figure that the photocopier did
12 find in the Gartner Lee portion, it's right after page
13 3 of the Gartner Lee portion of the report.

14 A. Yes.

15 Q. We see the very schematic I was
16 asking you to draw.

17 A. And in fact it's very similar to
18 what I did draw.

19 Q. You would agree that Figure 2 is a
20 reasonable representation of the situation?

21 A. As a schematic.

22 Q. The problem, am I right, is that
23 Bayview was constructed without a toe drain and an
24 underdrain?

25 A. Correct.



1 Q. Probably "construct" is probably
2 the wrong word to use to describe that kind of a
3 landfill site, is it not? At any rate, it would be
4 very difficult because of this undulating terrain at
5 the south end of the landfill site to put in a classic
6 kind of toe drain system?

7 A. Yes. In fact we did not put in a
8 classic system.

9 Q. What you are proposing to do
10 instead is deal with the problem of the leachate down
11 in each one of these valleys?

12 A. Correct.

13 Q. In fact that is where the leachate
14 seeps were?

15 A. Correct.

16 Q. The other part of alternatives 6
17 and 7 is toe collection systems on the west and east
18 boundaries. Can you describe to us what that proposal
19 called for?

20 A. Again I think there is a schematic
21 in the Dillon report or in Gartner Lee.

22 Q. Page 10?

23 A. Yes. That is a fair
24 representation of the western side of the site.

25 Q. Is this in fact a reasonable



1 representation of what you in fact set about building?
2 You've built a toe drain outside the refuse area and
3 down the slope?

4 A. We did some variations on this.
5 We extended the pipe deeper than five feet and extended
6 it down to approximately ten feet because I indicated
7 in chief we were trying to capture as much as possible,
8 the very shallow groundwater flow. We also extended it
9 at locations where there was seepage, granular banklets
10 up the bank to extend into the refuse.

11 Q. Perhaps we can come back to that
12 because I think we have a copy of a report that might
13 assist us. That was the toe collection system on the
14 west boundary?

15 A. Correct.

16 Q. Were you also proposing one for
17 the east boundary?

18 A. At that time we thought it might
19 be necessary to have one along the eastern boundary and
20 when we reviewed it in more detail we did not see the
21 need for that because there was one very small seep and
22 we felt that could be dealt with by excavation and
23 complete contouring and regrading.

24 Q. Let's talk about alternative 8 on
25 page 11. Alternative 8 is a variation on alternatives



1 3 and 6, is it not? First of all you are going to put
2 in the sumps along the south side and you will put in
3 the toe drains along the east and west boundaries and
4 then the add-on for this is you will put in a clay key
5 on the east and west boundary sides and southern area
6 ravines. Is that correct?

7 A. Yes.

8 Q. "This alternative is a long term
9 solution which addresses both leachate
10 seep and contaminated groundwater
11 collection at the Bayview Park landfill
12 site. The alternative is essentially
13 the same as Alternative No. 6 with the
14 addition of clay keys installed along
15 the eastern, western and portions of the
16 southern boundary. The clay keys would
17 be installed to a depth of approximately
18 20 feet ..."

19 And how deep is 20 feet in metres?

20 A. A little over three metres -- a
21 little over six metres, sorry.

22 Q. Six metres:

23 "...in the fractured shale environment.
24 This should be deep enough to intercept
25 the majority of groundwater flow leaving



1 the site. Groundwater intercepted
2 behind the key would be drained away by
3 the toe drains and sumps to the gravity
4 sewer on King Road. The leachate would
5 be pumped via a forcemain ..."

6 And then the last sentence:

7 "This alternative would require
8 approximately nine acres of off-site
9 property for implementation."

10 Is it fair to say, Mr. Crutcher, that if you are going
11 to construct clay keys south of the Bayview Landfill
12 Site on nine acres of property that they will be very,
13 very close to the toe of the landfill site?

14 A. Yes.

15 Q. Could you put up M-437-D5, please?

16 A. I should like to note that that
17 statement on groundwater is referring to what we called
18 shallow groundwater.

19 Q. We will come back to discuss what
20 groundwater is discussed in this report, Mr. Petrie --
21 Mr. Crutcher. We need another colour again. Maybe we
22 don't. Can we still go with brown? Would you indicate
23 for the Board approximately, since we are only dealing
24 with nine acres of land, how far downslope from the
25 Bayview Landfill Site did you think you were going to



1 put in your clay keys?

2 A. As I recall we were dealing with
3 something like up to about 50 metres down,
4 downgradient.

5 Q. You were planning to build it 50
6 metres south of the slope?

7 A. I don't recall exactly what we
8 were planning, but I think the distance we were working
9 in was about 50 metres.

10 Q. Somewhere in that 50 metres you
11 were going to put your clay key?

12 A. Yes, and that was a concept.

13 Q. I understand that. Would you draw
14 for us on M-437-D5 approximately where you were going
15 to put our clay key and please scale it so we could get
16 it 20 feet deep?

17 A. I have indicated the 50-metre
18 setback from the toe of the landfill site and have
19 placed the clay key six metres below the ground surface
20 at that location.

21 Q. Can you show me where that is?
22 Perhaps you could draw an arrow up here and indicate on
23 a legend clay key. Just for the record, would I be
24 right then that the clay key would appear to be
25 inserted into the ground from elevations 133 to



1 approximately 127?

2 A. Approximately that is correct.

3 This is based on this particular cross-section and you
4 would have to look along the whole profile of the
5 Bayview Landfill Site and along the western and eastern
6 boundaries to actually get a profile along it, but at
7 this particular location and using the 20-foot depth as
8 a criterion which we know is approximate, and we would
9 have to look at it at some detail, but that would
10 represent that.

11 Q. Thank you, Mr. Crutcher. Would
12 you tell the Board, please, what is a clay key?

13 A. It's a low permeable clay
14 compacted in place.

15 Q. There is no problem in digging
16 down 20 feet to install one?

17 A. I think 20 feet would be the upper
18 limit of your ability to dig down.

19 Q. The upper limit or the lower
20 limit?

21 A. You couldn't go much deeper than
22 that.

23 Q. You couldn't go much deeper than
24 that. What are the constraints, Mr. Crutcher?

25 A. Equipment constraints and the



1 difficulty in excavating the shale.

2 Q. The idea is that it is a low
3 permeability wall?

4 A. That's right.

5 Q. The concept is that leachate that
6 is migrating through shale when it reached that wall
7 would not migrate any further and it would be collected
8 behind the wall?

9 A. If you had a collection system
10 behind the wall.

11 Q. That would be your intention for
12 constructing a clay key to build a collection system
13 behind the wall?

14 A. Yes, that was one of the
15 considerations we considered.

16 Q. Could we jump ahead in this report
17 to page -- this report, am I right, was prepared for
18 the City of Burlington?

19 A. It was.

20 Q. And also for the Ministry of the
21 Environment?

22 A. Indirectly.

23 Q. The Ministry of the Environment
24 you understood would be reviewing your report and all
25 of your recommendations and they would be involved at



1 least in an approval capacity in making decisions as to
2 what kind of remedial alternative was to be in fact
3 installed at the Bayview Landfill Site?

4 A. As they are involved in every
5 landfill site.

6 Q. This report contains details on
7 the costs of these various alternatives?

8 A. The concept costs.

9 Q. And you client the City of
10 Burlington was acutely aware of the costs involved?

11 A. They have to pay for them so I am
12 certain they are paying attention to what the costs
13 would be because they must budget for that.

14 Q. There are two review agencies as
15 it were for this report, the City of Burlington and the
16 Ministry of the Environment?

17 A. Correct.

18 Q. Both of them have a stake in your
19 being accurate and fair in your report; right?

20 A. Yes.

21 Q. Now, let's read from page 18,

22 "ALTERNATIVE EFFICIENCIES":

23 "The alternatives as presented, have
24 various efficiencies in preventing off-
25 site contamination of Indian Creek. The



1 efficiencies for each site are based on
2 a total leachate surface seep flow of
3 five gallons per minute as a total
4 leachate flow of seven gallons per
5 minute entering the shallow and deeper
6 groundwater systems from the landfill
7 site. These estimates are taken from
8 the 1982 Dillon report."

9 If we go back in the 1982 Dillon report to page 5, I
10 had some difficulty I confess understanding this
11 sentence when I read it and so I checked it against the
12 1982 Dillon report and it became obvious that it was my
13 problem and not the sentence. What you are saying here
14 is that you are simply repeating, and I don't for a
15 minute suggest you are unfairly repeating what was
16 being said in the Dillon report at page 5, but the
17 Dillon report suggested the annual infiltration would
18 be 6.5 inches.

19 A. That was Gartner Lee and Dillon
20 are using it.

21 Q. Did I say Dillon?

22 A. Dillon.

23 Q. I meant to say Gartner Lee but
24 they report at page 5, the second full paragraph:

25 "From preliminary water budget



1 calculations, ..."

2 And Gartner Lee are suggesting that total infiltration
3 into the system is 6.5 inches.

4 A. Yes.

5 Q. And that translates to a total
6 annual average generation of leachate of 12 gallons per
7 minute; right?

8 A. Correct.

9 Q. They measured the leachate that
10 was emanating from the seeps of the landfill and they
11 saw five gallons per minute going out the seeps?

12 A. They estimated five, yes.

13 Q. From that they sort of deduced
14 that seven gallons per minute were exfiltrating the
15 bottom of the landfill site?

16 A. That is correct and all based on
17 their assumption of the infiltration into the landfill
18 site of 6.5.

19 Q. And you accepted their numbers in
20 this paragraph at the top of page 18 of H-675?

21 A. At that time, yes, we did and as I
22 indicated we did this in a very quick time frame
23 because of our concerns.

24 Q. I appreciate that, Mr. Crutcher,
25 but as quickly as you did it you got it right I suggest



1 and you got 12 gallons per minute of which five gallons
2 were going out the leachate seeps and seven gallons
3 were entering the shallow and deeper groundwater
4 systems under the landfill site and so your evidence
5 replicates Gartner Lee's evidence on this point?

6 A. We were using Gartner Lee
7 directly.

8 Q. So ...

9 A. That is what we note ...

10 Q. Sorry?

11 A. As a matter of fact that is what
12 we note at page 18 and say:

13 "These estimates were taken from the
14 1982 Dillon report."

15 Q. We translated all of these earlier
16 but what that sentence in the middle of the first
17 paragraph of this page translates to is that you are
18 working with an annual infiltration of 165.1
19 millimetres, not 60.5 inches and seven gallons per
20 minute out the bottom represents exfiltration into the
21 shale of 96.3 millimetres?

22 A. Correct.

23 Q. And exfiltration out the seeps
24 translates into 68.8 millimetres of infiltration into
25 the landfill?



1 A. Subject to your math being
2 correct, that is correct.

3 Q. You then go on to estimate the
4 efficiencies based on these assumptions about leachate
5 production and distribution:

6 "Alternative No. 2 has an estimated
7 efficiency of anywhere from 0 percent to
8 40 percent. The zero efficiency would
9 occur if leachate seeps again occur
10 after excavation and sealing of the
11 existing seeps. A 40 percent efficiency
12 would occur if the leachate seeps are
13 prevented from entering the surface
14 waters of Indian Creek completely."

15 So, just stopping up the seeps will in effect give you
16 a 40 per cent efficiency and that 40 per cent is really
17 the five gallons per minute?

18 A. If I could check that. If you get
19 five gallons per minute divided by 12 gallons per
20 minute you get 42 per cent so I think we were doing a
21 rounding.

22 Q. I appreciate that:

23 "Alternative No. 3 through 5 ..."

24 And 3 through 5 were more than just plugging the seeps
25 but creating these individual sumps across the bottom



1 of the landfill; right?

2 A. Yes.

3 Q. The difference as you will recall
4 between 3, 4 and 5 had to do with how the leachate got
5 off the site once it was collected, but in effect you
6 were going to collect leachate at the toe of the
7 landfill in those valleys at the site; right?

8 A. Yes.

9 Q. "Alternative No. 3 through 5 have
10 an efficiency in the order of 40
11 percent. These alternatives would
12 collect the leachate seeps and prevent
13 them from entering the surface waters
14 of Indian Creek."

15 Again we are just dealing with the five gallons per
16 minute going out the seeps and the sumps along the
17 south side would deal with the seeps; correct?

18 A. That is correct.

19 Q. "Alternatives No. 6 and No. 7 have
20 an estimated efficiency on the order of
21 75 percent. These alternatives would
22 collect the leachate seeps and also a
23 portion of shallow groundwater flow
24 around the site."

25 So now you are going to get not only the five gallons a



1 minute coming out the seeps, but you are going to be
2 able to capture approximately half of the seven gallons
3 per minute infiltrating the bottom of the landfill
4 site; right?

5 A. That is correct. I believe that
6 was off an assumption of the amount of leachate we
7 collect from the groundwater. I think it was 80 per
8 cent or something like that anyway.

9 Q. Let's just remember that
10 alternatives 6 and 7 have an add-on only of some toe
11 drains on the east side and on the west side because
12 you hadn't made a decision at this point to build them
13 on the east side so fairly they are on two sides?

14 A. Correct.

15 Q. These toe drains on the east side
16 and west side are going to capture another 35 per cent
17 of the leachate being generated by the landfill site?

18 A. That was our estimate at that
19 time.

20 Q. Over the page to page 19:
21 "Alternatives No. 8 and No. 9 are
22 anticipated to have an efficiency on the
23 order of 90 percent. The clay key or
24 berm would be installed to on the order
25 of 20 feet which should intercept a



1 great majority of contaminated
2 groundwater flow exiting from the site
3 on the south, east and west sides."

4 A. What page are you on?

5 Q. Nineteen.

6 A. Nineteen?

7 Q. Nineteen.

8 A. Sorry.

9 Q. Is your report different than
10 mine?

11 A. I was reading a different section
12 which is very similar. Carry on.

13 Q. Perhaps you should catch up with
14 me because I am now in the second sentence.

15 A. I see.

16 Q. The clay key down 20 feet, and you
17 have drawn it for us will:

18 "...intercept a great majority of
19 groundwater flow exiting from this site
20 on the south, east and west sides. This
21 assumes that on the order of 80 percent
22 of the groundwater flow flows in the
23 upper fracture zone around the site.
24 This is a reasonable assumption given
25 the weathering and fractures in the



1 upper 20 feet of the shale material and
2 has been confirmed by Morrison/Beatty in
3 their 1981 report ..."

4 A. Yes, and I believe that that 20
5 feet actually came from their report when we reviewed
6 that. I would like to refer you to your Phase 2 report
7 and I guess it is Figure A-5.

8 DR. KINGHAM: Does that have an exhibit
9 number?

10 MR. HODGSON: Exhibit 186. I'm reminded
11 that part but not all of that Phase 2 report is in
12 evidence and I don't know what section of the report
13 the witness is looking at so I can't tell ...

14 MR. CRUTCHER: The appendices, Appendix
15 A.

16 MR. HODGSON: Q. Appendix A?

17 MR. CRUTCHER: A. Figure A-5.

18 DR. KINGHAM: Are you referring us to
19 that part of that exhibit?

20 MR. CRUTCHER: Yes, I am. I would just
21 like to, if I may, do a calculation. Do you have that?

22 DR. KINGHAM: I have 186 but I just have
23 six pages plus the Roman Numerals.

24 MR. HODGSON: I would be happy for the
25 purposes of this examination to loan you my copy.



1 MR. CRUTCHER: I have an overhead of
2 that figure if that would be of any help. I believe we
3 obtained the 20 feet by taking the top two units which
4 are three metres and three metres, and I'm indicating
5 the permeability of the shale being 10^{-3} and 10^{-4} and
6 we were putting a cutoff wall down below that. Now,
7 what I was trying to see if the map works out is if you
8 added up all the discharges, whether that is 80 per
9 cent but it is not, it's 97 per cent and so I'm not
10 exactly sure where we got our 80 per cent estimate at
11 this time.

12 MR. HODGSON: Q. Focusing again on page
13 19 you are telling us that you were making use of some
14 information in Mr. Beatty's work; is that right?

15 MR. CRUTCHER: A. Yes, we were taking
16 all the information that was available and utilizing it
17 as factual and carrying it forward.

18 Q. I don't criticize you for a minute
19 because I assume that is an appropriate way to proceed
20 as a design engineer. Your conclusion then that was by
21 installing your clay key down to a depth of 20 feet and
22 installing the sumps and the toe drains, you could
23 collect a total of 90 per cent of the leachate being
24 generated at the Bayview Landfill Site; correct?

25 A. Yes, that's what it says and I'm



1 not exactly sure how we got that number and I would
2 have to work on how we got that number.

3 Q. I'm quite happy with the number,
4 Mr. Crutcher. So, let's do our sums. We have annual
5 infiltration into the Bayview Landfill Site of 165.1
6 millimetres, and that's what you accepted from Gartner
7 Lee, and 90 per cent of it is being collected and that
8 suggests to me that you are collecting a total of
9 148.59 millimetres.

10 A. That is correct.

11 Q. Leaving 16.5 millimetres
12 unaccounted for?

13 A. That is correct.

14 Q. Translating that into the language
15 of this hearing, that means the annual exfiltration
16 into the shale environment that would not be captured
17 in any way by your collection system and therefore make
18 its way wherever it was going to go was 16.5
19 millimetres?

20 A. That is correct and that was all
21 hinging upon the actual infiltration rate through the
22 landfill site of 6.5 inches which has been amended
23 significantly since that time.

24 Q. That was your advice to your
25 client, the City of Burlington, when this report was



1 written in July of 1985?

2 A. We indicated we used the
3 information and that is what had been provided and we
4 did not at that time review it in any more detail.

5 Q. In addition to providing your
6 client with that advice you also suggested to your
7 client you could increase the efficiency if they
8 acquired some 90 acres of land south of the landfill
9 site; correct?

10 A. Yes, and I think our rationale for
11 that is that we were unsure exactly what the
12 groundwater component was and we had the downgradient
13 attenuation zone and we had a greater safety margin.

14 Q. Can we look now at page 12?

15 A. Of H-675?

16 Q. Yes. Option B, the use of
17 downgradient land:

18 "As a further level of securement a
19 supplemental option ..."

20 Is security what you mean by securement?

21 A. Say again?

22 Q. The word is:

23 "As a further level of securement..."

24 Is that meaning security?

25 A. Yes, confidence.



1 Q. "... a supplemental option using
2 the downgradient land (i.e. the land
3 between the Bayview landfill and the
4 403) can be utilized for a buffer zone.
5 This land would assist in on-site
6 monitoring and would assist leachate
7 treatment by attenuation and
8 assimilation (sic) into the shale
9 environment.

10 The exact distance of land required
11 for a buffer zone in the environment is
12 difficult to estimate. Dr. Cherry had
13 done work on the Bayview property which
14 has been largely inconclusive in
15 determining the attenuation properties
16 and distances required for a proper
17 attenuation of leachate from the Bayview
18 Site."

19 I take it from that sentence that you have been
20 reviewing Dr. Cherry's work in this area?

21 A. Yes. We had reviewed the Morrison
22 Beatty reports and Dr. Cherry's report when we were
23 being prepared for the 1984 review of the Dillon
24 reports and hearings and we reviewed it at that time.

25 Q. In fact, Mr. Crutcher, isn't it



1 fair to say that when you wrote this report you were
2 relying on Dr. Cherry for his advice that most of the
3 contaminated groundwater that is expected to flow --
4 most of the contaminated groundwater from the Bayview
5 site that exfiltrates the bottom of the site was
6 expected to flow in the shallow flow system?

7 A. No, that is not fair to say and
8 I'm not exactly sure where you get that from. Could
9 you reference me where you are getting that
10 implication?

11 Q. Let me refresh your memory. Do
12 you recall on the 22nd of November, 1986 you swore an
13 affidavit in a proceeding in the Supreme Court of
14 Ontario between National Sewer Pipe Limited and the
15 Corporation of the City of Burlington?

16 A. Yes.

17 Q. Is that your signature?

18 A. It is.

19 Q. Could we read together paragraph
20 5:

21 "5. As part of the Halton Environmental
22 Assessment Review in 1984, we were given
23 copies of reports prepared by Dr. John
24 A. Cherry and others for the Regional
25 Municipality of Halton to assess the



1 suitability of landfilling on the
2 National Sewer Pipe lands located south
3 and west of Bayview Park. In the first
4 report dated October, 1980 entitled
5 'Hydrologic Suitability of NSP's
6 Landfill Site' the authors Dr. John A.
7 Cherry and Donald A. Lush stated ..."

8 And you say -- and these are direct quotations from the
9 report, are they not?

10 A. They are supposed to be.

11 Q. I checked them and they are.

12 A. That's good.

13 Q. "Based on the existing
14 hydrological data from the Bayview
15 landfill it appears that a large plume
16 of leachate contaminated groundwater has
17 developed in the shale and the zone
18 extends beneath and beyond Highway 403."

19 That was Dr. Cherry and secondly:

20 "(B) Most of the contaminated
21 groundwater is expected to flow in the
22 shallow local flow systems and discharge
23 on the National Sewer Pipe Limited
24 property."

25 And that was Dr. Cherry's opinion.



1 A. Yes.

2 Q. Am I right, Mr. Petrie, that you
3 are quoting Dr. Cherry because you agreed with his
4 opinion?

5 A. First of all it's Mr. Crutcher ...

6 Q. I'm sorry.

7 A. And secondly we took the
8 information as factual, what we had and we worked with
9 that to come up with the engineering design.

10 Q. I fully understand, Mr. Crutcher,
11 that that is what you were doing and I don't suggest
12 for a moment that you should be doing anything else,
13 but I just asked you isn't it the reason that you
14 quoted this paragraph from Dr. Cherry in this affidavit
15 sworn, and we didn't give the date for the record, the
16 date was the 22nd of November, 1986 and the reason you
17 quote Dr. Cherry is that when you wrote your report in
18 July of 1985 you agreed with Dr. Cherry's statement
19 that most of the contaminated groundwater is expected
20 to flow in the shallow local flow system and discharge
21 onto the National Sewer Pipe property?

22 A. We were taking that as a factual
23 piece of information we were using and this affidavit
24 was sworn on the basis of justification of why we
25 recommended the downgradient lands south of Bayview and



1 that was one of the rationales. We had other rationale
2 as well, but that was one of the rationales and it is
3 also one of the rationales why we were dealing with the
4 clay key and the attenuation zone and why we extended
5 our leachate collection pipe as deep as we could.

6 Q. I appreciate all that but now I
7 want an answer. You quoted from Dr. Cherry in this
8 affidavit in November of 1986 because you agreed with
9 Dr. Cherry's opinion that most of the contaminated
10 groundwater is expected to flow in the shallow local
11 flow systems and discharge on the National Sewer Pipe
12 Limited property. Correct?

13 A. At that time we used that
14 information as factual.

15 Q. You agreed with his opinion and is
16 that what you are telling me?

17 A. We did not investigate differently
18 so I used it as factual.

19 Q. You adopted his opinion?

20 A. We adopted his opinion at that
21 time.

22 Q. That became your opinion?

23 A. This affidavit was sworn to say
24 why we had recommended the downgradient attenuation
25 zone as detailed in H-675 and that was part of the



1 rationale and there were others.

2 Q. Then (C):

3 "It is suspected that the bulrush
4 marshes ..."

5 And this again is a quotation from Dr. Cherry's
6 October, 1980 report?

7 A. Yes, and I believe all four points
8 are quotations.

9 Q. "It is suspected that the bulrush
10 marshes are responsible for removing a
11 high percentage of contaminants from the
12 leachate. Preliminary studies have
13 indicated that a functioning bulrush
14 marsh can be much more efficient in the
15 removal of contaminants from leachate
16 than a conventional sewage treatment
17 plant."

18 Am I correct that you quote that sentence from
19 Dr. Cherry's report because you agreed with that
20 sentence as well?

21 A. Yes. I was aware of the
22 effectiveness of bulrush marshes on the treatment of
23 leachate and that particular one I could concur with
24 quite easily because I was aware of studies and the
25 success of those studies.



1 Q. Based upon ...

2 A. In fact if you recall in chief we
3 had indicated to the City of Burlington that we felt
4 that 90 acres would be advisable to acquire, but at the
5 minimum the swamp areas for that very reason.

6 Q. It's time we all took a break,
7 Mr. Crutcher, so let me finish with one question, and I
8 hope it's one question, and that is notwithstanding
9 that in Exhibit H-675, the remedial alternatives, you
10 are recommending 90 acres, it subsequently turned out
11 that you recommended 45 acres to your client?

12 A. I indicated to our client a
13 minimum of 45 acres would at least encompass the swamp
14 areas.

15 Q. Do you recall how many metres
16 south of the Bayview Landfill Site that 45 acres would
17 involve?

18 A. I think it's something like 300 or
19 a little over 300 metres.

20 Q. Could you look up the exact number
21 over the break and when we come back I would like you
22 on Exhibit M-437-D5 to show us where -- my recollection
23 is it's 345 or 355 metres but you have the reports and
24 would be able to find it. I would like you to be
25 prepared at that time to show the Board where on cross-



1 section M-437-D5 the final line you had suggested and
2 your client adopted falls on that section.

3 A. I would also like to be able to
4 indicate our rationale because you have not given me an
5 opportunity to explain the rationale for that.

6 Q. I will give you a full opportunity
7 and we will discuss this further, Mr. Crutcher.

8 A. Thank you.

9 MR. LANCASTER: Would 15 minutes be
10 enough?

11 MR. CRUTCHER: Yes.

12 --- Recess

13 MR. LANCASTER: Please be seated.

14 MR. HODGSON: I have handed out to my
15 friends and I will give copies to the Board of Figure 3
16 from that portion of the Gartner Lee report which was
17 incorporated into exhibit -- I think we can add it to
18 H-678 and it will make the document complete. I think
19 Mr. Crutcher earlier indicated that Figure 2 goes after
20 Figure 1 ...

21 MR. CRUTCHER: Figure 3 goes after
22 Figure 2.

23 MR. HODGSON: Q. Figure 3 goes after
24 Figure 2, thank you very much.

25 MR. CRUTCHER: A. Would you like me to



1 mark on this drawing the distances?

2 Q. Yes. What is the distance that
3 was finally settled on? The area was even less than 45
4 acres, was it not, 37 acres?

5 A. I thought it was 45.

6 Q. Put on the distance at any rate
7 and we will come back to talk about the area because
8 it's in another of your reports which I intend to put
9 into evidence.

10 A. There was a series of reports
11 prepared on the Bayview Landfill Site and the
12 construction. The distance I obtained was from the one
13 referred to as the detailed design report, leachate
14 collection system and surface drainage improvements and
15 at the back of the report is a plan that locates the
16 various areas we are referring to.

17 Q. I wonder if you would mind if that
18 was marked as an exhibit.

19 A. I wouldn't mind other than I would
20 have to get another copy. Let me make a note of that.

21 MR. LANCASTER: H-679.

22 MR. CRUTCHER: What was the number?

23 MR. LANCASTER: H-679.

24 --- EXHIBIT NO. H-679: Plan entitled "Total Land
25 Requirements, Bayview Landfill
Site" dated January 9, 1986



1 MR. LANCASTER: What is it again?

2 MR. CRUTCHER: A plan entitled "Total
3 Land Requirements, Bayview Landfill Site" dated January
4 9, 1986 and obtained from the report entitled "Detailed
5 Design Report, Leachate Collection System and Surface
6 Drainage Improvements, Bayview Landfill Site" dated
7 June, 1986.

8 MR. HODGSON: Q. I have an earlier copy
9 of that same map and am I right on this map on the
10 right-hand side it shows 355 metres and the area is 355
11 metres and on the left it says 305.

12 MR. CRUTCHER: A. That is correct and
13 the difference was the initial 50-metre buffer we
14 needed for construction works and when I indicated it
15 was just a little over 300, it was the 305 I was
16 referring to but if you take it from essentially the
17 toe of the landfill site the total distance is 355.

18 Q. Looking at Exhibit H-679, am I not
19 right that the toe of the landfill is further south
20 than that and that 355 incorporates some portion of the
21 toe?

22 A. It does. The toe is quite
23 variable and when we plotted on Exhibit M-437-D5, I'm
24 not exactly sure where this cross-section is, but for
25 illustration purposes I think it is fair to take it



1 from the toe.

2 Q. Can we take the number as about
3 345 metres from the toe? Would that be a fair
4 representation?

5 A. Three forty-five or 355 for our
6 purposes is fine with me. It depends upon where this
7 particular cross-section was taken.

8 Q. Show us where 355 metres comes on
9 the cross-section and recognizing we have some
10 difficulty.

11 A. Do you have a particular colour
12 you would like that in?

13 Q. Yes, green.

14 A. Oh, wrong scale. I have indicated
15 on the map from the toe of the landfill site a distance
16 of 355 metres outlined in green and with a projection
17 of a dashed green line to where it would intersect the
18 ground surface. That line is placed on M-437-D5.

19 Q. Am I right that it intersects the
20 ground surface just to the north of MB12?

21 A. That is correct.

22 Q. Now then, Mr. Crutcher, the
23 concept, and to go back and to represent fairly what
24 you are doing in H-675, the remedial alternatives, in
25 July of 1985 you weren't recommending the area you have



1 just now superimposed on the map, M-437-D5, you were
2 recommending a larger area being 90 acres or the full
3 distance to Highway 403?

4 A. Correct, to the North Service
5 Road.

6 Q. The North Service Road. This was
7 to be a leachate attenuation zone; is that right?

8 A. Yes, a contaminant attenuation
9 zone.

10 Q. And the concept for it really came
11 from Dr. Cherry's report, did it not?

12 A. No, Dr. Cherry's report provided
13 support but the concept is not novel at all when you
14 are dealing with a landfill site and you have
15 groundwater migration. You look for extended zones on
16 the downgradient side of the landfill site and this
17 recommendation to the City is a very common
18 recommendation we would make to any client in a similar
19 situation. Essentially as you pointed out on Exhibit
20 H-679, a portion of the landfill site had extended
21 beyond the property boundaries of the Bayview Park
22 Landfill and therefore there essentially was no buffer
23 zone and we were recommending a buffer zone for
24 attenuation purposes.

25 Q. Can we turn in this document,



1 H-675, after page 20 there are a series of tables.
2 Could I ask you to turn up Table 7.8, please? This
3 addresses alternative No. 8.

4 A. It does.

5 Q. It is explained alternative 8 is
6 alternative 6 plus clay keys on the east and west sides
7 and ravines along the south side and then it says under
8 "Advantages":

9 "- will control both leachate seeps, and
10 contaminated groundwater flow off
11 property permanently..."

12 And it is a permanent, long-term solution. Am I
13 correct that by installing your clay key in nine acres
14 of land, more or less nine acres of land as indicated
15 on Table 8.1, you would be able to provide a permanent
16 solution to groundwater contamination at the Bayview
17 Landfill Site and that is what is proposed?

18 A. We should add in the word
19 "contaminated" -- we should have added in "shallow"
20 because we were always dealing with the shallow system
21 and it's implicit within the whole document and I think
22 in the early part of the document we indicate we are
23 talking shallow and if you refer to the subsequent
24 documents which follow this report they were always
25 dealing with the shallow groundwater.



1 Q. The shallow groundwater is the
2 water you are going to be able to intercept flowing in
3 a distance of down to 20 feet below ground surface?

4 A. Yes, and we were basing that off
5 essentially the Morrison Beatty work.

6 Q. And no more than ten per cent of
7 the leachate was going to flow deeper than that 20
8 feet?

9 A. That was our estimate at that time
10 and based on the information we had and at the time we
11 were allocated to do the work.

12 Q. On Table 10 we have listed
13 advantages for Option B which is the downgradient land
14 use?

15 A. Table 7.10?

16 Q. Seven point ten and the advantages
17 are:

18 "- partial on-site treatment of
19 contaminated groundwater through natural
20 attenuation capabilities available in
21 buffer zone and marsh areas..."

22 So, first of all we have the concept here that the
23 shale has natural attenuation capabilities?

24 A. Yes.

25 Q. And also that there are marsh



1 areas south of the landfill site?

2 A. Yes.

3 Q. And can you just show us on
4 Exhibit H-679, can you show the Board where the marsh
5 areas are?

6 A. They are essentially in the
7 ravines and the southern portion of the area labelled
8 as C on H-679 is the southern extent of the marsh areas
9 which we indicated to the City of Burlington would be
10 our minimum area that we would like as a buffer zone.
11 As you pointed out, we had indicated we would like
12 completely down to the North Service Road, but the City
13 of Burlington wanted to know if they could reduce that
14 at all and we said at a minimum at least to the
15 southern portion of the marsh and they subsequently
16 chose to proceed with that.

17 Q. You will recall that you quoted
18 from Dr. Cherry's report in the affidavit and we were
19 reading a segment where he referred to bulrush marshes
20 and is it your understanding Dr. Cherry was talking
21 about the same bulrush marshes you were referring to?

22 A. I presume so, yes.

23 Q. Were you relying or using for some
24 support his statement that:

25 "Preliminary studies have indicated that



1 a functioning bulrush marsh can be much
2 more efficient in the removal of
3 contaminants from leachate than a
4 conventional sewage treatment plant."

5 A. I was aware of that from other
6 studies myself.

7 Q. Turning to page 22A of this report
8 we see that alternative 8 plus the 90 acres of land
9 gives an efficiency of greater than 95 per cent. Would
10 you agree with me that if the infiltration at Bayview
11 is 165.1 millimetres that 90 per cent is 156.8
12 millimetres?

13 A. It is.

14 Q. That meant then that of the
15 infiltration at Bayview only 8.3 millimetres was going
16 to escape your aggregate contamination collection
17 arrangements including the sumps, the toe drains, the
18 clay key and the 90-acre attenuation zone?

19 A. That was our estimate at that
20 time.

21 Q. In fact you were going to get
22 greater than 95 per cent and isn't that what Option B
23 is?

24 A. We couldn't estimate it but we
25 thought it was a fair number.



1 Q. The document says greater than 95
2 per cent so less than 8.3 millimetres of infiltration
3 would escape Bayview?

4 A. Yes.

5 Q. In order to get that extra five or
6 more per cent, the assumption is that the contaminants
7 that get underneath your clay key are still moving in a
8 shallow enough zone that they will surface in that
9 bulrush attenuation zone; is that right?

10 A. No. The assumption was there
11 would be attenuation within the shale and in fact it
12 would renovate the leachate product it received.

13 Q. You weren't going to rely on the
14 bulrush marshes?

15 A. We were as well. I consider the
16 bulrush marshes as a shallow system and I consider as
17 another system the deep system. The work we did was
18 essentially with surface water and dealing with surface
19 seepage and the shallow system and the deeper system we
20 said take it down to the North Service Road and we
21 don't know the distance but take it down to the North
22 Service Road and that is the best we could do and we
23 didn't do an estimate of what we felt would be the
24 capabilities of that at that time.

25 Q. Did you model the attenuation that



1 would take place in this attenuation zone?

2 A. Not at all. We made an estimate
3 just reviewing all the documents we had.

4 Q. An informed guess that that would
5 occur, attenuation would occur in that zone?

6 A. Yes, and taking the information we
7 had as factual.

8 Q. Mr. Petrie, would I be right that
9 after you presented to your client Exhibit H-675, the
10 remedial alternatives, and Exhibit H-677, the
11 contamination investigation, the City of Burlington
12 addressed this issue of leachate from the Bayview
13 Landfill Site?

14 A. They started addressing the issue
15 in a very active fashion when the Ministry of the
16 Environment wrote them in 1985 and proceeded
17 expeditiously from there on.

18 Q. Let me show you a copy if I could
19 of a resolution, a certified true copy of a resolution
20 from the City of Burlington dated the 22nd of July,
21 1985.

22 MR. LANCASTER: This will be H-680.

23 --- EXHIBIT NO. H-680: Resolution of City of
24 Burlington, dated July 22,
1985 (#SWM-69-85-1)

25 MR. HODGSON: Should it be an H or a B?



1 MR. CRUTCHER: In the past they have all
2 been submitted as H's.

3 MR. HODGSON: Q. You will see here that
4 the City of Burlington addressed your reports and you
5 will see in the paragraph numbered 1:

6 "Staff be directed to take immediate
7 action in accordance with Alternative 2
8 (Option A) as contained in Ecoplans/CRA
9 report entitled 'Remedial
10 Alternatives ...'"

11 And that is the report we now have?

12 A. It is.

13 Q. "2. a) Staff be directed to
14 discuss long term action with the
15 Ministry of the Environment in
16 accordance with one of Alternatives 3
17 through 9 (Option B) ..."

18 So 3 through 9 are the options for sumps and toe drains
19 and clay keys plus they read that as Option B so that
20 also included the 90 acres or included some
21 downgradient contamination zone?

22 A. Yes.

23 Q. Then 2 b):

24 "The amount of downgradient land
25 required in Option B for buffer zones,



1 monitoring and attenuation and
2 assimilation capacity be established at
3 approximately 45 acres ... for purposes
4 of commencing expropriation
5 procedures; ..."

6 A. Yes.

7 Q. It would appear your client didn't
8 accept your recommendation for 90 acres and made a
9 decision to go with 45 acres. Am I missing a document
10 or did you give your client any advice subsequent to
11 the remedial alternative report to suggest that 45
12 acres was appropriate or did they make that decision in
13 the absence of any advice you may have given them?

14 A. I said several times we met and
15 discussed and they asked for our rationale for why the
16 90 acres and we indicated that we felt they needed a
17 downgradient buffer zone and we had inadequate data to
18 be able to tell us the exact extent of that buffer zone
19 and we felt -- I think at that time we had just
20 received the Hewetson report and we had done a
21 periphery review of the Hewetson report or thesis and
22 we felt there was some contamination becoming evident
23 south of the Bayview Park Landfill. We did not know
24 the extent of that and we felt it was the safest way to
25 proceed which would be to take it, the attenuation zone



1 down to the North Service Road and we also indicated
2 when they requested did we have a minimum area and we
3 said at least to the southern end of the marsh and they
4 chose to take the minimum area.

5 Q. I'm showing you again the figure
6 we were looking at for the site plan area for Site F
7 from Exhibit H-38. Do you recall this, dated June,
8 1985? Can you in looking at the site plan area, and
9 this is the page preceding page 61 in H-38, but the 45
10 acres we are talking about and which is depicted as
11 area C on H-679, when in fact it overlapped to some
12 extent with the proposed limit -- proposed location of
13 a landfill at Site F?

14 A. Yes, it would. I think we noted
15 that at the end of our document at H-675 on page 23
16 where we say we recommended option 7 and we go on to
17 say:

18 "This recommendation is based solely on
19 technical and economic merits and does
20 not consider the feasibility of NSP or
21 Region of Halton landfilling on these
22 downgradient lands."

23 We did not consider that when we were preparing this
24 documentation.

25 Q. This resolution of the City that



1 we have before us as H-680 is addressing the problem at
2 Bayview and was passed on the 22nd of July, 1985;
3 correct?

4 A. Correct.

5 Q. Do you recall, Mr. Crutcher, that
6 on the evening of the 23rd of July, 1985 ...

7 A. Sure.

8 Q. I can lead you because I think I
9 will be able to help you with your memory on this. On
10 the evening of July 23, 1985 it was a very hot, sticky
11 summer evening and all of the players in the Halton
12 landfill saga were gathered together in the Regional
13 Council Chamber where Regional Council was meeting to
14 discuss the Stage 2C reports which are all in evidence
15 in this proceeding and in fact Council that evening
16 adopted those reports and also adopted a lengthy
17 recommendation for the CAO to retain a whole bunch of
18 consultants to do a whole new round of studies called
19 the EPA studies. Attending that night were any number
20 of members of the public and also other parties at this
21 proceeding including the CAO for the City of
22 Burlington, the solicitor for the City of Burlington,
23 counsel to the City of Burlington, Mr. McQuaid's
24 partner Mr. Stein, and you yourself were there.

25 A. I can't recall the date but I was



1 at one of those type of meetings.

2 Q. You were at the meeting where
3 Regional Council adopted the EA documents?

4 A. I suspect I was but I have been at
5 a lot of meetings.

6 Q. That was the day after this
7 resolution deciding to expropriate a portion of Site F
8 was passed by the City of Burlington, the 23rd of July.

9 A. I was checking because it says
10 "commence expropriation proceedings." So, yes.

11 Q. It was passed on the 22nd and the
12 meeting of Regional Council to adopt the reports was
13 the 23rd.

14 A. I'm taking your date as being
15 factual.

16 Q. Do you recollect on that occasion
17 counsel to the City of Burlington announced to Regional
18 Council there would be a problem with landfilling at
19 Site F because the City of Burlington was going to
20 expropriate part of it?

21 A. Yes, I recall that there was a
22 discussion about that.

23 Q. Thank you very much. Now,
24 Mr. Petrie -- Mr. Crutcher, sorry, this subject of the
25 45 acres of land did not die after the 23rd of July,



1 1985, did it?

2 A. It has been rather controversial.

3 Q. Somewhat. I don't want to get
4 into that controversy, but that controversy affected
5 and it did not directly involve the Region, but I want
6 to show you three other reports you wrote and so that
7 the Board has the advantage of your evidence as to how
8 to interpret them, as to what is going on. The first
9 is a conceptual design report dated January, 1986, and
10 I will apologize in advance but when I copied these I
11 don't believe the maps were copied and I don't think
12 anything turns on the maps, but if you feel I have not
13 represented your report accurately by omitting anything
14 then please feel free to advise me and the Board and
15 I'm more than happy to have more copied.

16 MR. LANCASTER: H-681.

17 --- EXHIBIT NO. H-681: Report entitled "Conceptual
18 Design Report Leachate
19 Collection System and Buffer
20 Land Requirements Bayview
Landfill Site City of
Burlington" dated January 1986

21 MR. HODGSON: Q. I don't propose to
22 deal with this and the subsequent two reports in any
23 great detail, but I just want to identify for the Board
24 the destiny of the leachate contamination zone. You
25 will notice first of all if we turn to page 3 that the
purpose of the report is set out in the middle of



1 page 3.

2 A. Yes.

3 Q. "The purpose of this report is to
4 provide the City and MOE with the
5 conceptual design of a recommended
6 system to control surface water
7 contamination of the upper reaches of
8 Indian Creek from the Bayview Site. The
9 objectives of the leachate control
10 system are as follows;

- 11 1. To collect and prevent leachate
12 contaminated groundwater seepage from
13 the Bayview Landfill Site from flowing
14 overland and entering the Indian Creek
15 system.
- 16 2. To collect shallow contaminated
17 groundwater at the landfill site margins
18 and prevent these contaminated waters
19 from discharging into Indian Creek.
- 20 3. Provide long term access to the
21 leachate collection system for
22 maintenance and monitoring.
- 23 4. Provide for sufficient buffer zones
24 for installation of the leachate
25 collection systems, access roads,



1 contingency groundwater cutoff wall and
2 downgradient attenuation/treatment
3 zone."

4 Would I be right in assuming that when this was written
5 in January of 1986 the concept of the clay cutoff wall
6 was still alive and well?

7 A. If I may explain what happened to
8 that clay cutoff wall, and it ties from a bit of the
9 history ...

10 Q. Excuse me, I will forget my
11 question so would you answer my question and then go
12 ahead with your explanation?

13 A. It was our recommendation to
14 maintain the cutoff wall as a contingency item after
15 discussions with the Ministry of the Environment. Now
16 if I may explain how that came about.

17 Q. Please do.

18 A. The Ministry of the Environment
19 were very concerned about contamination within Indian
20 Creek and wanted a system installed as soon as possible
21 and the City was moving as quickly as possible on that
22 item. We advised the City that while we were dealing
23 with the matter that we should not just be dealing
24 solely with the surface water discharges but we should
25 also be dealing with groundwater and we should be doing



1 it all at one time since they tied very much together.
2 The Ministry of the Environment did not want to deal
3 with the groundwater at that time and in fact we had a
4 meeting where they said proceed without dealing with
5 the groundwater. We did not feel that was an
6 appropriate method to proceed and therefore we
7 recommended to the City that at least we maintain
8 sufficient lands surrounding the downgradient side of
9 the landfill so we could install a cutoff wall if the
10 need arose. We also recommended a downgradient
11 attenuation zone. We felt we should be dealing with
12 the complete site and not just dealing with the surface
13 water. The Ministry of the Environment somewhat
14 segregated themselves from the groundwater aspects and
15 would not deal with it. They said they would deal with
16 that at a later time. We had to go into negotiations
17 with NSP on acquiring land or at least having the
18 rights to construct the leachate collection system on
19 their lands and the downgradient attenuation zone was
20 also on their lands so it seemed wise we should be
21 dealing with both matters at the same time.

22 As I said the Ministry of the
23 Environment was not dealing with it and we recommended
24 to our client we should be dealing with it. Because we
25 could not establish essentially what the cutoff wall



1 would be and whether in fact it was needed or not
2 needed, we had only preliminary indications of it and
3 we said we would like to leave it as a contingency
4 measure and to ensure there was sufficient land for
5 that and we also recommended a downgradient attenuation
6 zone.

7 Q. I appreciate that explanation and
8 I'm happy to have it, but let me explain that in my
9 questions I am really not addressing the views of the
10 Ministry of the Environment or the concerns that may
11 have been expressed by other parties like NSP. I
12 really want to concentrate solely on the opinions of
13 you, Mr. Crutcher, because I believe you are the author
14 of each one of these reports.

15 A. One of the authors.

16 Q. I don't suggest I am confining you
17 to that, but I am saying that that is my orientation
18 and I'm trying to understand your opinions.

19 A. My opinions are very much based
20 off other reviewers' comments and where we differed on
21 that, obviously that had to be represented to the City
22 of Burlington and at that particular time that was a
23 rather important item and we differed with the Ministry
24 of the Environment and I thought it was worthy to put
25 it forward. The Ministry of the Environment did not



1 indicate they weren't concerned about groundwater but
2 they just did not want to deal with it at that time.

3 Q. It's your recommendations I want
4 to focus on and not the destiny of the recommendations.

5 A. Our recommendations came in as a
6 contingency measure because we could not essentially
7 get any sign-off from the Ministry of the Environment
8 on groundwater and we had really very little discussion
9 on the groundwater aspect.

10 Q. Page 4 continuing, the last full
11 paragraph:

12 "The leachate collection system is
13 designed to control leachate discharge
14 to the surface water from surface
15 seepage and shallow groundwater flow."

16 In fact what you were proposing to build was your
17 option 6 or 7, was it not, from the previous report and
18 it was to be a series of sumps across the south and a
19 toe drain on the west side?

20 A. Yes. We had eliminated the
21 eastern portion of the collection system. Essentially
22 that is a variation and we have now gone into a more
23 detailed design but I think option 7 may have had it
24 going down the NSP land if I am not mistaken. I'll
25 just check that.



1 Q. That's not material because I'm
2 not concerned about how the leachate gets off-site
3 once it is collected. I really want to concentrate on
4 the collection aspects. The collection aspects were
5 the sumps on the south and a toe drain along the west
6 side?

7 A. And a contingency cutoff wall.

8 Q. But you weren't going to build the
9 cutoff contingency wall?

10 A. But we were allowing room so we
11 could.

12 Q. So the leachate collection system
13 is designed to control leachate discharge to the
14 surface water from surface seepage and shallow
15 groundwater flow and I want you to relate that to what
16 you are proposing which is the sumps and the toe drain.

17 A. I indicated that we extended them
18 as deep as we felt was practical which was three
19 metres.

20 Q. I understand:

21 "However, the system does not address
22 the deeper groundwater flow component
23 through the fractured shale. Therefore,
24 increased buffer zones are proposed
25 downgradient of the landfill for



1 || attenuation and treatment purposes."

2 That in fact was the section C we were looking at?

3 A. I believe at that time ...

4 Q. Let me show you the map that came
5 with my copy of this document and it's the same map I
6 think, would you agree, as H-679?

7 A. Just one minute, please. My copy
8 does not have that map.

9 Q. Let me show you my copy of the map
10 dated January 9, 1986 as is the copy you put into
11 evidence. In fact it is the same map?

12 A. It appears to be.

13 Q. That coincides, does it not, with
14 the date of the report you are looking at?

15 A. The date of the report is January
16 30, 1986.

17 Q. So that map would have been
18 prepared before the report was distributed?

19 A. Yes.

20 Q. I suggest that coincides with the
21 date of the report.

22 A. I'm just not sure if it was in
23 this report or not.

24 Q. Thank you:

25 "Therefore, increased buffer zones are



1 proposed downgradient of the landfill
2 for attenuation and treatment purposes.
3 If, in the future, it is determined that
4 the deeper groundwater flow component
5 must be addressed it will be necessary
6 to increase the downgradient buffer zone
7 and/or the installation of the
8 contingency cutoff wall."

9 Am I right that that sentence and be fairly interpreted
10 to read that when it comes time to address the deeper
11 groundwater flow system that can be done by building
12 the clay cutoff wall, the 20-foot clay cutoff wall?

13 A. It says "and/or" and it may be
14 that or that with additional land.

15 Q. You considered that one possible
16 way of dealing with groundwater flow and the second
17 possible way to was install that and have additional
18 downgradient lands; right?

19 A. What I was doing was trying to
20 keep all my options open and the cutoff wall we had
21 extended down six metres and the collection system we
22 installed was only three metres and so we could
23 eliminate flow for that further three metres and I
24 wasn't sure whether that would do anything for our
25 deeper groundwater system and in fact our



1 recommendation for the deeper groundwater system was
2 take the land at least to the North Service Road and
3 that is why we say we may be required to do that in the
4 future. There was no more land to acquire and that is
5 why we came to that boundary and there was nothing
6 magical about that boundary, that was the extent of the
7 land.

8 Q. The point, Mr. Petrie, is that
9 Gartner Lee in Exhibit H-678 when they wanted to
10 address the deeper flow, they were going to put a
11 series of drains 45.5 metres down, right, or purge
12 wells?

13 A. Purge wells.

14 Q. Down 45.5 metres?

15 A. I think they were referred to as
16 about 30 metres they were talking about.

17 Q. You drew it on M-437-D5 and the
18 purge wells are down at 94.5 metres. Do you remember?

19 A. Yes, but there is an inconsistency
20 between the Gartner Lee report and the Dillon report
21 and what we drew and I don't think anything turns on
22 that. Gartner Lee refers to 100 feet and Dillon refers
23 to 140 feet which -- and if we turn that into metric
24 it's 42. I'm not exactly sure where the discrepancy
25 came from.



1 Q. We agreed the Gartner Lee report
2 proposed putting the drains, or the purge wells in at
3 310 feet above sea level which you translated as 94.5
4 metres and plotted it on M-437-D5.

5 A. That's correct. I thought we had
6 come across a place where they referred to it as being
7 100 feet.

8 Q. That was the spacing between them.

9 A. I may be incorrect.

10 Q. Am I right that Dillon were going
11 to address the deeper groundwater flow by putting in
12 drains that were 45 metres below the landfill and you
13 were going to address the deeper groundwater flow by
14 putting in a 20-foot cutoff wall which you were kind
15 enough to draw for us on M-437-D5?

16 A. The shallow flow.

17 Q. Mr. Petrie, you were going to get
18 90 per cent of the leachate -- Mr. Crutcher, you were
19 going to get 90 per cent of the leachate with that and
20 I suggest that that may be shallow flow but it was also
21 most of the flow, wasn't it?

22 A. Upon reviewing the documents we
23 had at the time that is what we felt was a good chunk
24 of the flow. I would like to note there is again a
25 contradiction between Cherry who indicates the shallow



1 flow and Figure 3 which was omitted inadvertently from
2 the document. If you refer to Figure 3 from the Dillon
3 report you will notice that the plume which they are
4 delineating has an upper limit and it says 25 feet down
5 and it shows it proceeding at depth if you follow the
6 flow arrows on that. We were dealing with the shallow
7 system being in the 25 feet and the deeper system we
8 were dealing with would be the downgradient attenuation
9 zone.

10 Q. It was your view, was it not, in
11 1985 that that shallow flow was most of the flow that
12 was exfiltrating from the base of the Bayview Landfill
13 Site?

14 A. As I indicated I felt it was a
15 good chunk of it and we tried to estimate the numbers
16 and they were our best guess based on the information
17 and most of that number came from Morrison Beatty's
18 information.

19 Q. On page 4 you say, page 4 of
20 H-681:

21 "If, in the future, it is determined
22 that the deeper groundwater flow
23 component must be addressed it will be
24 necessary to increase the downgradient
25 buffer zone and/or the installation of



1 the contingency cutoff wall."

2 I'm suggesting you were going to address the deeper
3 groundwater flow with a 20-foot clay cutoff wall and a
4 bit of an attenuation zone downgradient; isn't that
5 right and isn't that what that sentence tells us?

6 A. Yes, because our performance
7 monitoring of the site would then be established at the
8 downgradient side of the buffer zone.

9 Q. The clay key is to address the
10 deeper groundwater flow not the shallow groundwater
11 flow?

12 A. The deeper groundwater flow was
13 being dealt with by the downgradient lands and the
14 cutoff wall was dealing with the shallower groundwater
15 flow.

16 Q. Is that how this reads:
17 "If, in the future, it is determined
18 that the deeper groundwater flow
19 component must be addressed it will be
20 necessary to increase the downgradient
21 buffer zone and/or ..."

22 So let's read it with "or" and leave out the "and":

23 "...or the installation of the
24 contingency cutoff wall."

25 You are saying you can address deeper groundwater flow



1 by the installation of a contingency cutoff wall,
2 aren't you?

3 A. The design of the system was only
4 placing the collector tile down three metres and we
5 were dealing with a depth of approximately six metres
6 and so we have a difference of three metres to deal
7 with and maybe our terminology is a bit misleading. We
8 were dealing with that extra three metres at that
9 point.

10 Q. Look at the first sentence with
11 the last sentence and the first sentence addresses
12 shallow groundwater flow and the system you in fact
13 went about installing was to address shallow
14 groundwater flow and the cutoff wall will address
15 deeper groundwater flow and that is how the paragraph
16 reads?

17 A. You can read it that way but I
18 know that that was not the intent. As you know I am
19 the author and I am very much aware of what the intent
20 of the document was and you may read it that way but I
21 read it in a different fashion.

22 Q. Could you turn to the next page,
23 please? Do you recall in your evidence in chief you
24 had a figure very like this figure in which you showed
25 leachate levels at the Bayview Landfill Site and then



1 -- it was an overhead figure on which you were also
2 showing the Board and giving evidence about your 1987
3 monitoring report and you suggested to the Board that
4 leachate levels had dropped and you redrew the contour
5 lines. Can you find that overhead?

6 A. Mr. Petrie is going to find that.
7 I believe I have it. Is this the one you are referring
8 to? Mr. Hodgson, is this the one you are referring to?

9 Q. It is. I just want to suggest to
10 you, Mr. Crutcher, and let me see if I have this right.
11 The contour lines with the smaller numbers are the
12 earlier contour lines and the contour lines with the
13 larger numbers are the later contour lines and the
14 later contour lines show lower leachate levels; is that
15 right?

16 A. Marginally.

17 Q. That is the reason you put them in
18 a different place?

19 A. Yes. When we contoured up they
20 did move somewhat and if you look at it visually there
21 appears to be a change and when you look at the actual
22 numbers, the numbers within the tables are a marginal
23 change.

24 Q. Could I ask you to -- what you did
25 -- let's look at 150. The more northerly 150 is for a



1 higher level of leachate than the southern 150?

2 A. Yes.

3 Q. Is that right?

4 A. It is.

5 Q. Mr. Crutcher, I suggest to you
6 that when you prepare a document such as this where you
7 are contouring the leachate head on a sloped surface
8 that where there is a lowering of the head, the contour
9 line should have been moved to the north rather than
10 the south. I couldn't figure this out until I held my
11 pen on an angle like this and I imagined that was the
12 surface of the head in the landfill and I imagined
13 lowering it and when I lowered it, lo and behold this
14 little line moved north rather than south.

15 A. You are quite correct.

16 Q. Can I ask you in this same
17 document to turn up page 15, please?

18 A. I'm not exactly sure why we ended
19 up doing it that way, but my interpretation of the
20 margin was based on the numbers and the contours were
21 what the contours were and I obviously didn't give it
22 much thought. I'm sorry, what document?

23 Q. We are still in H-681 and are in
24 area C. Now, this is page 15. You are reviewing in
25 this segment of your conceptual design report the



1 rationale for the acquisition of the three segments of
2 land and area A we can see on H-479 is a portion of the
3 NSP lands lying to the west of the Bayview site and B
4 is another portion of the NSP lands to the west of the
5 Bayview site but south of portion A and portion C is a
6 segment of land to the south of the Bayview Landfill
7 Site; correct?

8 A. That is correct.

9 Q. You needed A and B because you
10 were going to install leachate collection works right
11 on those lands?

12 A. Only B and area A was because
13 there was refuse beyond the property boundaries as
14 highlighted in the tone and if in the future we needed
15 to install any works, we could.

16 Q. When I was in first year law
17 school that was called trespassing, putting your
18 garbage on someone else's land.

19 A. I was just noting it.

20 Q. Ms Cronk reminds me it's still
21 called that. Area C on page 15:

22 "Area C is the largest portion of land
23 required and is located adjacent to the
24 existing southern property boundary as
25 shown on Plan 1. Area C contains a



1 total of 16 ha. (39.47 acres). The new
2 proposed southern property boundary
3 extends 335 meters south of the existing
4 southern property boundary."

5 Nothing is perfect in this world, Mr. Crutcher.

6 A. I'm trying to figure out where we
7 got 39 acres. Carry on.

8 Q. I don't think anything turns on it
9 so could you work it out at lunch hour?

10 A. Yes.

11 Q. Thank you:

12 "This land is required for the following
13 reasons:

14 1. Natural attenuation of contaminants
15 found in the deeper groundwater, which
16 discharges to the stream systems south
17 of the present Bayview property boundary
18 and bypasses the proposed shallow
19 groundwater collection system."

20 So here we have you are going to address deeper
21 groundwater flow with your attenuation zone; correct?

22 A. We are detailing that extra three
23 metres we did not install the system into and our
24 nomenclature between shallow and deeper is somewhat
25 confused obviously and we should have used some other



1 terminology for that middle zone.

2 Q. I suggest you weren't confused at
3 all and you knew exactly what you were talking about.
4 You have already told us in another document that 80
5 per cent of the flow moves in the shallow zone and you
6 knew if 80 per cent moved in the shallow zone that you
7 could capture it if you went downgradient in the
8 shallow zone. If we look at M-437-D5, and can we put
9 up M-437-D5, just pull it to the right. If we look at
10 where that 300 -- if we look at where your line comes
11 and what property you were proposing to take, am I not
12 correct that the shallower flow is going to emerge on
13 the NSP property within that 355-metre boundary and it
14 would come out into a bunch of bulrush marshes and in
15 fact those bulrush marshes were there because of that
16 leachate, weren't they?

17 MR. McQUAID: Which question do you want
18 answered?

19 MR. HODGSON: Let's start with the last
20 one first.

21 Q. The bulrush marshes were getting
22 their recharge from the Bayview Landfill Site?

23 MR. CRUTCHER: A. In part.

24 Q. They were the physical emanation
25 of the shallow flow from the landfill.



1 A. Prior to the landfill being there
2 there was a ravine which was feeding water from where
3 now the Bayview landfill site is and the marshes were
4 obtaining water from the Bayview Landfill Site and from
5 discharge from the adjacent shales.

6 Q. The discharge from the adjacent
7 shales you thought might include some leachate?

8 A. Yes.

9 Q. That leachate had moved
10 horizontally through that shale from an area
11 upgradient, or up to the north. The shales are
12 horizontal ...

13 A. Or adjacent. If you were to refer
14 to discharge and you will recall when Dr. Charlesworth
15 and Dr. Rowe were up we were dealing with discharge and
16 what was the infiltration and they had discounted the
17 very upper portions of the discharge and when I am
18 referring to the discharge it's the very upper portion
19 and the adjacent shales would be contributing to that
20 marsh area as well.

21 Q. You were going to address the
22 deeper groundwater flow at this site by expropriating
23 the marshes and letting the leachates exfiltrating from
24 the Bayview Landfill Site emerge at surface in that
25 location; correct? That is what this paragraph means?



1 A. It's not what it means. What I
2 indicated was that our shallow flow system was dealing
3 with the upper 20 feet and we installed a system within
4 the upper ten feet and when we say we could put in a
5 cutoff wall we would extend it down deeper and that
6 flow system we felt discharged on site or had a good
7 potential to discharge on site and the deeper flow
8 system we did not have an appreciation of and that is
9 why we did not understand its flow system or
10 significance and therefore we recommended the
11 downgradient attenuation zone farther than the marsh
12 area.

13 Q. We'll come back to that. That was
14 your conceptual design report and the next report I
15 have is dated June, 1986, a detailed design report.

16 MR. LANCASTER: This is H-682.

17 --- EXHIBIT NO. H-682: Report entitled "Detailed
18 Design Report Leachate
19 Collection System & Surface
20 Drainage Improvements Bayview
21 Landfill Site City of
22 Burlington" dated June, 1986

23 MR. HODGSON: Q. Again, Mr. Crutcher,
24 you are the author of this report?

25 MR. CRUTCHER: A. One of them. I
indicated I acted as project manager on all the work
undertaken so I am the common person for all the work
undertaken for the City of Burlington.



1 Q. I don't want to spend a lot of
2 time on this report either, but I do want the Board to
3 have your evidence as to what was happening here.
4 Again on page 3 we see:

5 "The purpose of this report is to
6 provide the City and the MOE with the
7 design background of the recommended
8 system to control surface water
9 contamination of the upper reaches of
10 Indian Creek from the Bayview Site. The
11 objectives of the leachate control
12 system are as follows;

- 13 1. To collect and prevent leachate
14 contaminated groundwater seepage from
15 the Bayview Landfill Site from flowing
16 overland and entering the Indian Creek
17 system.
18 2. To collect shallow contaminated
19 groundwater at the landfill site margins
20 and prevent these contaminated waters
21 from discharging into Indian Creek."

22 One and 2 I suggest to you were going to be
23 accomplished with your combination of sumps and toe
24 drains; is that right? That is what you were proposing
25 to build at this location?



1 A. Yes.

2 Q. "4. Provide for sufficient buffer
3 zones for installation of the leachate
4 collection systems, access roads,
5 contingency groundwater cutoff wall and
6 downgradient attenuation/treatment
7 zone."

8 So, you were still proposing you need a downgradient
9 attenuation zone?

10 A. I believe the wording in this is
11 probably a regurgitation of what was in the conceptual,
12 or it should be. What we were going from is from a
13 conceptual design because the Ministry asked for a
14 detailed design report to give all the rationale and we
15 placed it all in one document and so in fact I think
16 this is a compilation.

17 Q. This paragraph is a paragraph we
18 have already studied, isn't it?

19 A. It should be.

20 Q. "It should be." What it tells us,
21 does it not, is when it comes time to address the
22 deeper groundwater flow component, the last sentence,
23 it will be necessary to increase the downgradient
24 buffer zone and/or the installation of the contingency
25 cutoff wall?



1 A. We have discussed all this.

2 Q. So, in this report as in the
3 previous report in January you were proposing to deal
4 with a deeper groundwater flow system with either a
5 contingency cutoff wall or more of an attenuation
6 buffer zone; correct?

7 A. The contingency wall would deal
8 with the balance of the shallow groundwater flow that
9 we had not dealt with with this system and the
10 downgradient attenuation zone was dealing with the
11 deeper groundwater flow system.

12 Q. Mr. Petrie -- Mr. Crutcher, I can
13 I understand how when you write a report you could make
14 a mistake about shallow and deeper once but I can't see
15 how you could make the same mistake in report after
16 report. I suggest you did not make a mistake here and
17 you said deeper groundwater because you meant deeper
18 groundwater; correct?

19 A. No.

20 Q. You produced this report for your
21 client the City of Burlington and for the Ministry of
22 the Environment and this was your best advice on behalf
23 of your firm, Conestoga-Rovers, as to how to deal with
24 deeper and the shallower leachate exfiltration at the
25 Bayview Landfill Site; correct?



1 A. In my mind it was very clear what
2 the shallow and deeper system was and when we prepared
3 the documents it was still clear in my mind and maybe
4 the words do not make it as clear, but within my mind
5 it was very clear and I was the principal in our firm
6 who was directing the work and the intent -- it depends
7 upon which way you read this, but the intent of the
8 document was that we were dealing with a shallow
9 groundwater flow and we put the installations down at
10 three metres and the cutoff wall was to deal with the
11 additional flow and the deeper system we did not
12 understand and that is the system we felt we should be
13 dealing with as an attenuation zone. Recognizing this
14 work is dealing with engineering works because we were
15 primarily orienting ourselves with engineering works to
16 deal with what the Ministry of the Environment
17 identified as a serious contamination of Indian Creek
18 and they wanted it done, the contamination remediated
19 as quickly as possible.

20 Q. On page 40 ...

21 A. What?

22 Q. On page 40 again you are dealing
23 with the justification for expropriation of this area C
24 and at the top of page 40 we have:

25 " This land is required for the following



1 reasons:

2 1. Natural attenuation of contaminants
3 found in the deeper groundwater, which
4 discharges to the stream systems south
5 of the present Bayview property boundary
6 and bypasses the proposed shallow
7 groundwater collection system."

8 You are telling us the deeper groundwater bypasses the
9 proposed shallow groundwater collection system and it
10 discharges to the streams?

11 A. So we have a nomenclature problem
12 -- not nomenclature but the way we described it. We
13 should have had three systems, a three-system basis and
14 we have interchanged shallow and deeper and it is
15 misleading, I agree, it is misleading when you read it
16 in that fashion.

17 Q. So now we have two reports and
18 both you are telling us are misleading?

19 A. As I indicated they were a
20 compilation of the previous reports and we did not do
21 them over again but just compiled them together and I
22 believe that that was the request of the Ministry of
23 the Environment. They wanted a compiled report because
24 we had a number of reports which we brought together
25 and as you may note if you carry on because there is an



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Crutcher, Petrie,
ex (Hodgson)

1 addendum 1 to the detailed design report because they
2 had comments on this and they wanted more details as
3 well.

4 MR. HODGSON: I think, Mr. Chairman, I
5 am going to move on to something else and this would be
6 a convenient time.

7 MR. LANCASTER: Yes, it would be. Until
8 a quarter to 2:00.

9 --- Luncheon recess (12:20 p.m.)

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1 --- Upon resuming at 1:45 p.m.

2 MR. LANCASTER: Thank you. Please be
3 seated.

4 MR. CRUTCHER: Mr. Petrie is just coming
5 down.

6 MR. LANCASTER: Whenever you are ready.

7 MR. HODGSON: I was looking through. I
8 knew I had my cross-examination somewhere.

9 Q. Mr. Petrie, just a small point
10 that I thought you and I should discuss briefly. Last
11 night I showed you a cross-section onto which
12 monitoring reports from your firm, CRA, and by Miss
13 Hewetson and also by Gartner Lee had reported some
14 findings of toluene in and around the vicinity of
15 proposed Site F.

16 MR. PETRIE: A. I'm not sure
17 Miss Hewetson reported toluene, but figures associated
18 with their endeavors indicated toluene, yes.

19 Q. In some of her wells at any rate?

20 A. Correct.

21 Q. Perhaps we should call them the
22 University of Waterloo wells.

23 A. Exhibit H-86A as you have noted.

24 Q. Can you accept subject to check,
25 and I know Mr. McQuaid will regret I am making you do



1 this much work, that we have summarized the relevant
2 toluene findings on the cross-section before you?

3 A. You have presented toluene numbers
4 on this cross-section, yes.

5 MR. HODGSON: Could we give that a
6 number?

7 MR. LANCASTER: H-683.

8 --- EXHIBIT NO. H-683: Chart - Toluene

9 MR. PETRIE: This is Exhibit H-683, the
10 toluene occurrences in micrograms per litre.

11 MR. HODGSON: Q. Now, Mr. Petrie, can
12 we discuss briefly where toluene was not found? You
13 will notice that the stainless steel piezometers which
14 were tested for substances including toluene are coded
15 on the exhibit with a blue dandelion or asterisk.

16 MR. PETRIE: A. An asterisk, a dark
17 blue asterisk, yes.

18 Q. We see, do we not, that in every
19 location where we have a stainless steel well we don't
20 have a finding of toluene?

21 A. I see four stainless steel well
22 installations, being GL24, GL27, GL26 and HC15, and I
23 recall you indicated to me the other day that the
24 bottom piezometer of HC15 is indeed PVC and that is
25 consistent with the data you have provided on the



1 exhibit so therefore, yes, the stainless steel wells do
2 not record occurrences of toluene.

3 Q. If you would turn back to Exhibit
4 H-658 which was the fingerprint for the contaminants at
5 the Burlington Landfill Site,...

6 A. I have, it yes.

7 Q. ... you will see that toluene is
8 one of the less mobile of the contaminants with a log
9 (Koc) of 2.69.

10 A. Of the contaminants on that
11 exhibit.

12 Q. Of the contaminants going back to
13 the second page of that exhibit, of the contaminants
14 that were found in installations south of the
15 Burlington Landfill Site, GL24, GL16, toluene was not
16 one of the contaminants that had reached those
17 locations?

18 A. I believe you are only showing
19 GL24-3.

20 Q. It hadn't reached GL24.

21 A. Toluene had not been detected at
22 GL24, piezometer 3, that is my understanding.

23 Q. But toluene does show up in trace
24 quantities in GL16?

25 A. Do you have -- you do. It is



1 indicated on GL16, yes.

2 Q. That would suggest that if it
3 could reach GL16 then it must have somehow got past
4 GL24?

5 A. I'm not sure they are in a direct
6 line but in a general sense, yes. GL16 is further
7 downgradient from the landfill than is GL24.

8 Q. This is one of the less mobile
9 contaminants but if it in fact came from the landfill
10 it has to have travelled further than the more mobile
11 contaminants did to reach GL24?

12 A. I'm sorry, if it came from the
13 landfill and that is your assumption, then it would
14 have to travel ...

15 Q. It's a less mobile contaminant
16 than the contaminants we find at GL24?

17 A. Correct.

18 Q. Toluene is less mobile than the
19 contaminants which have already reached GL24?

20 A. That is correct.

21 Q. It is possible is it not, and we
22 have a cross-section of the Burlington Landfill Site
23 and perhaps we should get that out.

24 A. Has it been hanging up here
25 before?



1 Q. Yes.

2 A. It may have been folded and put
3 away.

4 Q. Oh, no, it's one of these on the
5 floor. Perhaps we could put this up behind the
6 Chairman and that would make it possible. The witness
7 is telling me his neck is getting a great deal of
8 workout by flipping back and forth and I apologize but
9 now this means your neck gets to have a workout.

10 A. I believe we may have photographs
11 of that.

12 Q. I'm sure we do. We have four
13 more mobile contaminants that reached GL24?

14 A. I see four compounds indicated
15 adjacent to GL24 and referring back to the exhibit you
16 mentioned earlier, H-658, they are more mobile than
17 toluene, yes.

18 Q. And there are some contaminants --
19 we have contaminants located in GL16 in the upper two
20 piezometers?

21 A. We do.

22 Q. I believe we discussed the
23 possibility that that may not be an accurate reading in
24 the second piezometer because of the chloride levels.
25 Could you get out the chloride cross-section and



1 perhaps Mr. Crutcher could put that up behind you?
2 It's very difficult to do anything without the chloride
3 data. What we have in GL16 is we have very high
4 chlorides, would you agree, in the bottom three
5 piezometers?

6 A. The lower three of the four, yes.

7 Q. Strangely enough in GL16 on H-683
8 which is right behind you, the toluene exhibit, we find
9 toluene is not in the upper piezometer which already
10 had two other contaminants ...

11 A. I have lost the well again.

12 Q. GL16.

13 A. Right, it's not in the upper
14 piezometer.

15 Q. Where we have DCE and TCE.

16 A. Correct.

17 Q. They are more mobile, you would
18 agree, than toluene?

19 A. With reference to the Koc values
20 shown in H-658, yes.

21 Q. We have three toluene readings
22 further down that piezometer?

23 A. We do.

24 Q. That is a PVC piezometer?

25 A. With reference to the construction



1 data you have on H-683, it is.

2 Q. Would you agree that based on the
3 chloride data and the fact we don't find it in the
4 stainless steel wells at GL24, we should put at least a
5 bit of a question mark in our mind as to whether or not
6 those toluene readings at GL16 are in fact accurate and
7 that they represent landfill-derived contaminants?

8 A. I recall coming to the conclusion
9 that one should suspect that the toluene may not be
10 landfill derived in our monitoring report.

11 Q. Yes. In fact would you agree with
12 me, Mr. Petrie, that there has been at least one find
13 in this area of natural gas during a drilling
14 operation?

15 A. I am noting as you have indicated
16 on H-683 with pale blue a vertical bar adjacent to
17 MB17, natural gas flow from borehole 5 CFM.

18 Q. If you wouldn't mind turning up
19 the core log for MB17, Mr. Feenstra was kind enough to
20 point that out to me when we read your monitoring
21 report, but it would appear that Mr. Beatty made a find
22 when he drilled that hole?

23 A. He made an observation but I'm not
24 sure he was drilling for gas.

25 Q. There is an old joke in this part



1 of Ontario about striking oil. I come from
2 Southwestern Ontario where some people have in effect
3 done it. You will see on the borehole log for OW17-81
4 that down between approximately 17 and 20 metres they
5 struck natural gas and it reads:

6 "Natural gas discharge starting at 50
7 feet, 15.2 metres. Approximately 5 CFM
8 - odourous."

9 A. Correct, that is what the wording
10 says.

11 Q. Can you confirm that natural gas
12 contains among other ingredients toluene?

13 A. I read something the other week on
14 that and that is my recollection but ideally I couldn't
15 confirm it. Natural gas contains a lot more methane
16 and I'm not sure of the sum of the trace constituents
17 or the less concentrated constituents.

18 Q. I suggest that one of the
19 constituents is toluene.

20 A. If you could give me a reference
21 to which you could address me or a page number
22 specifically. You may indeed be correct because I'm
23 not well versed in natural gas chemistry.

24 Q. We can in fact do that,
25 Mr. Petrie. You can confirm, can you not, or at least



1 accept for the moment from H-683 that when you tested
2 that well you found toluene in it as well?

3 A. I would have to find our report.

4 Q. I don't think it's necessary for
5 you to look it up. The reality is you tested MB17 and
6 as I recall your report you found toluene in three or
7 four of the wells you tested.

8 A. Correct, MB17 and others.

9 Q. Yes.

10 A. Yes, that is correct.

11 Q. Would you agree that if toluene is
12 a constituent of natural gas and if natural gas was
13 indeed found as Mr. Beatty reports in his MB17, that it
14 is very likely the toluene that is being detected and
15 in the testing procedures is in situ?

16 A. Given those assumptions, yes, it
17 is possible.

18 Q. Could we also agree that 5 CFM,
19 what does that mean?

20 A. Five cubic feet per minute is
21 CFM's.

22 Q. Would you agree with me,
23 Mr. Petrie, that that natural gas was probably
24 generated some time ago, the natural gas Mr. Beatty
25 struck in MB17?



1 A. Do you mean in geologic times?

2 Q. Yes.

3 A. Yes.

4 Q. It has been trapped in the rock?

5 A. Most likely.

6 Q. In fact it could only be trapped
7 in the rock, could it not, if the rock had a very low
8 permeability above it?

9 A. A low permeability to gas or maybe
10 there is some sort of change induced in the pressures
11 within the system as a function of drilling, but I'm
12 not qualified to comment on that.

13 Q. You would agree that highly-
14 fractured rock wouldn't be a very ideal environment to
15 trap natural gas, wouldn't you?

16 A. No, it would not be an ideal
17 environment in which to trap natural gas.

18 Q. In fact natural gas would manage
19 to find its way out of rock that was even weakly
20 fractured, would it not?

21 A. I suspect it may, but I'm really
22 beyond my field of expertise.

23 Q. I am suggesting to you that given
24 the fact that Mr. Beatty found natural gas in MB17 at
25 15.2 metres below ground surface, what we have is



1 another example of a very tight zone and with very low
2 permeability rock and the very finding of natural gas
3 confirms that?

4 A. I disagree with the word "confirm"
5 but it can lead you toward that conclusion. The
6 absence of it at other places suggests the opposite
7 conclusion, that the rock is more permeable and the gas
8 could escape but, that is making the assumption that
9 the gas had a more uniform distribution in the first
10 place and that I don't know.

11 Q. Would you agree that if you are
12 drilling with an air rotary drill you are very unlikely
13 to know if you hit natural gas?

14 A. Correct.

15 Q. If you were drilling with a mud
16 rotary drill you might get a bit of a surprise because
17 there might be something coming up the borehole besides
18 mud, namely natural gas and you would notice it?

19 A. Yes. It would have to displace
20 the mud in some fashion, yes.

21 Q. That would mean that any of these
22 holes that have been air rotaried could in fact have
23 struck natural gas and no one would be the wiser for
24 it?

25 A. That is speculative but they could



1 have. They could equally as well not have.

2 Q. While we are looking at MB17 and
3 talking about the permeability in that hole, can you
4 confirm that MB17 is a hole that is just north of
5 Highway 403 and intimately related to HC8-85? Just
6 looking at your plan view on page 19.

7 A. "Intimately related to HC8-85?"
8 I'm having trouble understanding what you mean by
9 intimate relationship. It is north of Highway 403.

10 Q. HC8 and MB17 aren't very far
11 apart, are they?

12 A. Actually we can pick that off from
13 your cross-section.

14 Q. I don't think you can as I think
15 you need to see it in plan view. The cross-section
16 tells you how far in a north-south longitudinal
17 direction they are separated, but I think you need the
18 plan view in order to understand geographically how
19 they are related to one another.

20 A. I have a plan view before me and
21 with respect to the site dimensions I wouldn't agree
22 they were intimately associated -- I'm not sure what
23 you mean by "intimate".

24 Q. We can talk about these tomorrow
25 morning when we talk about the pumping tests but you



1 will recall there was no response at MB17 to the PW-1
2 pumping test?

3 A. There was no monitoring data
4 provided in the interrogatories and we assumed the
5 absence of data indicated no response was recorded and
6 given that that well was located on the plan view -- I
7 believe the horizontal distances are in that and can we
8 refer to that for a moment, please?

9 Q. Sure.

10 A. I am looking at the location of
11 pumping test PW-1 in Exhibit H-84, a plan view sketch
12 here and taking the common measuring point being MB13,
13 MB17 is 154 metres to the west and HC8 is 460 metres to
14 the west and subtracting those two would give us an
15 approximate measure of the separation of those two
16 wells and I get 306 metres.

17 Q. Did this plan view not suggest to
18 you, Mr. Petrie, that MB17 and HC8 were monitored
19 during the pumping test?

20 A. That is what we agreed the other
21 day, yes, and because no data is provided in the tables
22 preceding that you have indicated I should be led to
23 believe no drawdown was recorded at that location,
24 specifically HC8?

25 Q. I wouldn't want to lead you to



1 believe anything.

2 A. I believe you have done that and I
3 have agreed subject to check, I have been taking your
4 belief. You have provided me the data which I will
5 attempt to review tonight and check your assumptions.

6 Q. Looking at H-683 we have, would
7 you agree with me, that with three exceptions, WAT3,
8 WAT7 and GL16, we don't have much in the way of toluene
9 findings between the Bayview Landfill Site and MB17 on
10 the one hand or between the Burlington Landfill Site
11 and HC15 on the other? Perhaps I should separate the
12 two questions. Let's take two lines and one line from
13 Bayview down to HC9-85 and would you agree that is a
14 cross-sectional view through those?

15 A. It is a view of select wells that
16 lie on that cross-section you indicated, yes.

17 Q. We have a relatively high toluene
18 reading in MB1?

19 A. We do.

20 Q. You will recall that that's the
21 place where there was chlorobenzene and
22 paradichlorobenzene as well?

23 A. That is my recollection.

24 Q. Then we have not for the first
25 time in WAT4, but four toluene readings that are

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1 relatively speaking the same?

2 A. For each of the sampled piezometer
3 intervals, yes.

4 Q. Then we have some readings in WAT7
5 that are relatively the same?

6 A. Correct.

7 Q. But a little lower?

8 A. Generally a little lower.

9 Q. Then we have in HC9, particularly
10 the bottom -- the highest readings we find in this
11 cross-sectional view, wouldn't you agree, from Bayview
12 down to HC9?

13 A. Correct.

14 Q. You have 190?

15 A. We have 190 at the bottom
16 piezometer of HC9-85 which appears to be the highest
17 number on this section.

18 Q. I think we can agree that this
19 evidence suggests that the toluene being found in these
20 piezometers bears no relationship at all to the
21 contaminants that may or may not have moved from the
22 Bayview Landfill Site?

23 A. I believe I concluded in our
24 monitoring report that it was unlikely and I also
25 looked at the general hydrocarbon constituents and it



1 was my expectation that if one was to encounter
2 hydrocarbons in some form there might be a suite of
3 volatile constituents, xylenes and benzenes and I
4 believe I concluded one cannot be definitive about an
5 origin and to that end we suggested additional
6 monitoring, and part of it was to collect a sample of
7 the rock from the appropriate elevation and do a
8 hydrocarbon scan and could we match the volatile
9 constituents in the groundwater with those in the rock
10 and were they to match in some fashion that may provide
11 definitive information regarding a natural source for
12 the toluene occurrences, yes.

13 Q. Could I take you, please, to your
14 Exhibit B-617 at page 112? We have a section that goes
15 over to the top of page 115 which is described in the
16 report as "HYDROGEOLOGIC CONCEPTUALIZATION." I would
17 like to, if I could, read through it with you and ask
18 you some clarifying questions:

19 "Any explanation of the hydrogeology of
20 this site must account for the generally
21 steep downward hydraulic gradients
22 encountered on the site."

23 Now, perhaps you could put up for me the hydraulic
24 gradient cross-section we were looking at yesterday and
25 it could be put up beside the chloride one if that's



1 okay. I want the one on site for Site F.

2 A. Is that the one you mean?

3 Q. Yes, thank you. The next sentence
4 reads:

5 "The steepest gradients are generally
6 encountered at depth with lateral
7 gradients in the upper portions of the
8 rock."

9 If you would turn around and look at H-668 would you
10 agree with me that as with all simple generalized
11 statements about Site F, that is not quite correct to
12 say that the steepest gradients are generally
13 encountered at depth, given that what we see here is
14 that the steepest gradients, would you agree, are the
15 gradients over 0.5?

16 A. For the values we have, being the
17 red indications, it is a generalization statement
18 provided.

19 Q. But also the green segments
20 suggest, and I think you agreed yesterday, strong
21 downward gradients varying from 0.1 to 0.5?

22 A. The numbers you have indicated
23 from 0.1 to 0.5, yes.

24 Q. So would you agree that what we
25 see here when we talk about the steepest gradients, and



1 I know you didn't have this in mind when you were
2 writing that sentence and I don't mean to suggest
3 otherwise, but looking at H-668 the steepest gradients
4 we find at the bottom of HC4 and HC3 and we find them
5 at or toward the top of HC6 and HC5 and the steepest
6 gradients we find in HC8 again are at the bottom?

7 A. That is the pattern you have shown
8 here, yes.

9 Q. The reality is that with the sole
10 exception of the top 25 per cent of HC8 we find strong
11 downward gradients at the top of each of the other four
12 boreholes on site, don't you agree?

13 A. I believe we had this discussion
14 yesterday and the numbers were strong, stronger and
15 more strong and I generalized as you have indicated
16 here in red that the strongest gradients at the site
17 are encountered at depth in HC3 and 4 and as you
18 pointed it out it would be appropriate to describe the
19 relative positions at HC5 and 6. I'm not sure if I
20 have answered your question and could you repeat it?

21 Q. I don't think I can. What did I
22 ask?

23 THE REPORTER: (Reading back) "Q. The
24 reality is that with the sole exception
25 of the top 25 per cent of HC8 we find



1 strong downward gradients at the top of
2 each of the other four boreholes on the
3 site, don't you agree?"

4 MR. PETRIE: We have variably strong
5 downward gradients over the site with the sole
6 exceptions of the one noted here, the upper portion of
7 HC8.

8 MR. HODGSON: Q. Just looking at H-668
9 would you agree with the second half of the sentence
10 which reads:

11 "... with lateral gradients in the upper
12 portions of the rock."

13 There isn't a lot of evidence for lateral gradients in
14 the upper portions of the rock?

15 MR. PETRIE: A. When I'm referring to
16 lateral gradients, that is the more gentle downward
17 gradients being the blue zones indicated at less than
18 0.1 and they are sandwiched between steeper downward
19 gradients where you have a sandwiching of the gradient
20 change and I'm indicating there has to be a component
21 of lateral flow to accommodate that.

22 Q. We find that, would you agree, in
23 three of the five boreholes we are looking at in H-668?

24 A. Correct.

25 Q. "Downslope off the site, the



1 gradients are generally subhorizontal
2 with some upward gradients encountered
3 beneath the adjacent residential area of
4 Aldershot."

5 Here I would like to raise with you a problem which we
6 encountered and which we have brought to your attention
7 and which we now need to bring to the attention of the
8 Board. Would you agree with me, Mr. Petrie, that where
9 we find water with very high salinity we have water
10 with a different density than the water we usually
11 encounter in the glasses we drink?

12 A. Yes. You did bring this to my
13 attention last evening and I can't find my piece of
14 paper but higher salinities -- water with high salinity
15 has a density in excess of that of unsalinized water or
16 drinking water, yes.

17 Q. Would you agree with me that if
18 that's the case then it would be appropriate wherever
19 we have information that we can use to determine the
20 density that we need to engage in what is called a
21 density correction for the reading in the piezometer?

22 A. That would be an appropriate
23 consideration, yes.

24 Q. My apologies to the Board,
25 Mr. Chairman, but it appears that this is a matter that



1 was missed until Mr. Feenstra brought it to my
2 attention and he will have to help me with this because
3 this is not an area I really understand very well.
4 Could you please explain to the Board -- could we give
5 this a number?

6 MR. LANCASTER: H-684.

7 --- EXHIBIT NO. H-684: Document entitled "Hydraulic
8 Head Measurements Corrected
for Differing Density"

9 MR. HODGSON: Q. Can you explain in as
10 much detail as you think is appropriate why we need to
11 engage in a density correction and how one carries out
12 a density correction?

13 MR. PETRIE: A. I would start by
14 explaining how. As I see in this exhibit, H-684, your
15 consultant has related the conductivity of the waters
16 to a density and I imagine he could do that using the
17 chlorides in some wells and noting the correlation
18 between chlorides and conductivities as one way of
19 doing it or just taking the conductivities, per se. I
20 see the graph on the second page and I might indicate I
21 didn't have a chance to review this last evening as
22 there were a number of things you asked me to check,
23 but I imagine the graph on the second page of H-684
24 comes from a standard text.

25 Q. I am advised the graph comes from



1 a text, Hem, H-E-M, 1970.

2 A. I am acquainted with that text.

3 Q. A fairly standard relationship?

4 A. Oh, yes.

5 Q. This is not exotic information?

6 A. Not at all. Taking the density

7 there for the conductivities and noting the

8 conductivities as they are provided on the third page

9 of this document your consultant has arrived at the

10 estimated density for the fluid in the piezometer.

11 Now, what does this mean with respect to the measured

12 water level? That is available on the first page of

13 the document.

14 A piezometer is a device for measuring
15 pressure, to put it in crude terms, and that portion of

16 the piezometer through which the pressure changes are

17 introduced into the instrument is the water screen at

18 the bottom and the rise of the water within the

19 piezometer is the measure of the pressure at the

20 bottom. I often imagine this in lay terms as like a

21 thermometer where you have the mercury bulb at the

22 bottom which records the temperature and the

23 temperature change is recorded up the stem of the

24 thermometer. One can put that in the vertical and with

25 a little bit of imagination imagine a piezometer



1 providing a similar fraction, but it measures the
2 screen interval at the bottom of the piezometer which
3 is that portion of the rock mass -- I beg your pardon --
4 - is adjacent to that portion of the rock mass for
5 which the fluid pressure is recorded and the height of
6 water level rise in the system is the magnitude of the
7 pressure. For a density of one, which is common for
8 most regular groundwaters, no density corrections need
9 to be provided. However, for deep piezometers and for
10 high salinities in the height of water in this system,
11 it ought to be corrected for the weight of water in
12 order to arrive at a height of what would be an
13 equivalent freshwater head or equivalent freshwater
14 levels. I understand that to be what is provided -- I
15 see two pages, 3 and 4, and page 3 provides the
16 corrected heads recognizing the density of the fluid in
17 the sampled piezometer and page 4 recognizing the
18 corrected heads which we would call equivalent
19 freshwater heads. Then your consultant has
20 recalculated the gradients in the system, i.e., for
21 those piezometers for which the density contrasts were
22 such that an equivalent freshwater head made some
23 difference in the water levels.

24 Q. Would you agree with me that these
25 density corrections are unlikely to show any



1 significant effect on site because we have very
2 substantial head differences between piezometers on
3 site?

4 A. The gradients are very steep and a
5 small change in the water level will not make a big
6 numerical change to the gradient, and assuming there is
7 some separation between the piezometers.

8 Q. But where we are dealing with head
9 changes that are very small, a few centimetres of head
10 difference, it could in fact show a gradient we thought
11 was going one way in fact was going the other way?

12 A. It may indeed show that.

13 Q. Would you agree it's crucial to
14 understanding the flow system south of Highway 403 that
15 we understand exactly which way water is flowing in
16 that system?

17 A. We ought to know which way water
18 is flowing, yes.

19 Q. What we have also done is taken
20 the data, the corrected data from H-689, H-684 and
21 plotted it up on cross-sections and the idea being that
22 the Board have the best evidence available as to what
23 is happening in these piezometers, particularly south
24 of Highway 403. What I want to show you, Mr. Petrie,
25 is first of all we have taken the cross-sections from



1 H-40, cross-section A and cross-section B and I want to
2 present you with two copies of each and the first one
3 has measured potentiometric levels and the second has
4 the substituted or corrected -- potentiometric
5 pressures corrected for water density and I wonder if
6 we could put them up and mark them and then look at
7 them.

8 MR. McQUAID: Could I ask whether
9 Mr. Petrie has had an opportunity to see these and
10 consider them?

11 MR. HODGSON: We gave him the
12 information last night.

13 MR. McQUAID: On these sheets?

14 MR. HODGSON: I don't believe these
15 sheets were shown to Mr. Petrie, but this is the data
16 from the sheets Mr. Petrie has and if Mr. McQuaid is
17 concerned about how I will treat his witness, I only
18 want him to describe what is on these documents and I'm
19 not going to take it any further. The information is
20 rather self-explanatory.

21 MR. LANCASTER: Go ahead and put it to
22 the witness.

23 MR. HODGSON: I'm showing you a cross-
24 section at the top measured potentiometric levels and
25 showing downward red arrows for recharge gradients,



1 yellow upward arrows for discharge gradients and
2 lateral gradients marked with a red X. I would ask
3 that be made the next exhibit.

4 MR. LANCASTER: H-685.

5 MR. McQUAID: Before it is made an
6 exhibit, I don't understand how we just put an exhibit
7 in and then it is left there. What is Mr. Petrie
8 supposed to do? What is this all about and why don't
9 we get copies of what is now being put in as an exhibit
10 before it goes in? We can't even see the numbers from
11 back here and I have no idea of what this is all about
12 and I don't see how our witness is used to put in
13 something that should be put in by some other witness
14 or which should have been put in by some other witness.
15 I don't understand what this technique is of just
16 filing a document and saying "Now it is an exhibit."
17 What's the point, Mr. Hodgson? Can you give us a
18 little light here on what's going on?

19 MR. HODGSON: Mr. McQuaid's witnesses
20 are very interested in upward gradients south of
21 Highway 403 and on the measured potentiometric levels
22 we have some upward gradients and we also have some
23 downward gradients. When the gradients are corrected
24 for water density we have a lot more upward gradients
25 and I am sure that both Ms Vigod and Mr. McQuaid when



1 they understand this exhibit will get very excited
2 about this beneficial evidence. The reality is I have
3 already made an apology to the Board because it is
4 something that was missed and we want the Board to have
5 the best evidence and the evidence you do have should
6 be corrected so you have in fact the best evidence.
7 All that is happening here is that we are trying to
8 correct the evidence we have already put in for water
9 density and we have in the witness box a qualified
10 hydrogeologist who has taken it upon himself at my
11 request to explain to you how this is done and why it
12 is appropriate. I don't think we are doing anything
13 inappropriate in the circumstances and we are providing
14 this Board with better evidence than it already has as
15 to what the gradients are, particularly south of
16 Highway 403.

17 MR. McQUAID: I didn't suggest he was
18 doing anything of any nature. It's just that it wasn't
19 explained what was being done. I wanted to know what
20 the purpose of this was. I agree the Board is entitled
21 to corrected information and it's not just my witnesses
22 who have attested to upward gradients because all the
23 hydrogeologists have looked at the gradients, upward
24 and downward gradients. If there is something that
25 should come to the Board's attention I have no



1 objection, but it should be done in some sort of manner
2 so the rest of us know what's going on.

3 MR. LANCASTER: I would think so, so we
4 all understand what's going on.

5 MR. HODGSON: Yesterday Mr. McQuaid took
6 a strip off me in front of you because I wasn't telling
7 the witness enough ahead of time so now I tell the
8 witness what I need ahead of time and now I'm being
9 told I erred because I wasn't telling Mr. McQuaid as
10 well.

11 MR. McQUAID: Just a moment ...

12 MR. HODGSON: I'm sorry, but I don't
13 think I have to rehearse my cross-examination in front
14 of Mr. McQuaid. I do have an obligation to be fair to
15 his witness and I suggest I have been fair to his
16 witness and his witness has amply demonstrated his
17 understanding of this information and his ability to
18 explain it to you.

19 MR. McQUAID: With respect, we are
20 entitled, all counsel and particularly me because it is
21 my witness who is in and I can't discuss any of this
22 evidence with the witness and I'm supposed to deal with
23 it in reply. I have the right to understand the
24 evidence as it's going in. As a matter of fact
25 Mr. Lederer complained very bitterly when one document



1 or two documents were put because he hadn't seen them
2 first and hadn't had a chance to see the report and
3 hadn't had it explained to him and didn't know what the
4 questions and answers would therefore be. I'm not
5 going that far but I am saying we are entitled to
6 copies of a document, a document like this. I suppose
7 at the break I could go up and pour over it, but I
8 think we are entitled, Burlington and other counsel
9 are entitled to copies of documents so that while the
10 questions or whatever are being asked then we can
11 follow them. We have that responsibility to our
12 clients and so I say Mr. Hodgson does have a
13 responsibility to show documents to me and other
14 counsel as they are going in to ensure that we follow
15 them and so indeed the Board can follow them.

16 Secondly, I don't understand why there
17 has to be some sort of adversarial position taken on a
18 document which is to correct information from his case.
19 Very simply it could have been said at lunch time "I
20 will be correcting the gradients and we have done a
21 recalculation and this is just going in and I hope you
22 will agree it should go in" and I would have said
23 "Fine." Now why must it be put to the witness as some
24 sort of secret or adversarial point at this point in
25 the proceedings I have no idea. I am asking for copies



1 and I'm asking to be allowed to follow the evidence as
2 it goes in and I'm asking as well to know where it's
3 going and particularly where it's something as I
4 understand it is a correction. I don't think any of
5 those requests are unreasonable.

6 MR. HODGSON: Taking those points in
7 reverse order, I don't recall I have done anything
8 adversarial in the way I have presented this evidence.
9 I certainly did comply with the Board's request that
10 where I could I notified the witness in advance.
11 Mr. Feenstra explained Exhibit H-684 to the witness
12 last evening and I suspect he did a better job of it
13 than I could have done explaining it to the witness.
14 As to the question of Mr. McQuaid having copies, Mr.
15 McQuaid has copies of the data, it's all here on
16 Exhibit H-684. This is an example of a situation where
17 we have data and in order to understand what the data
18 means we have plotted it up on a cross-section. It's
19 very difficult to plot up ten examples of that.
20 However, his own witness has been very helpful to all
21 of us by taking colour photographs of these each
22 evening and providing them to us and I'm sure we can
23 prevail on Mr. Crutcher to do the same again. I would
24 have thought Mr. McQuaid could have waited until
25 tomorrow to get a copy of it.



1 MR. McQUAID: I want to understand it
2 now.

3 MR. HODGSON: As for Mr. McQuaid's
4 difficulty in understanding the evidence, he has
5 sitting beside him a qualified hydrogeologist and so
6 does every other counsel in this room except Ms Vigod
7 and I hereby undertake if Ms Vigod would like to have
8 Mr. Feenstra explain this evidence, but I am sure she
9 has already grasped it.

10 MR. McQUAID: I would still like to have
11 copies of the documents as the evidence is going in if
12 that can be done and I'm sure that in this case it
13 could be done.

14 MR. HODGSON: Mr. Chairman, I could list
15 50 exhibits Mr. McQuaid has drawn up, nice, big graphs
16 and all kinds of stuff and put it to witnesses and they
17 have stood up there and none of us has ever complained,
18 but when I put up a document he must have a copy in
19 advance. I suggest that that is not a reasonable
20 request.

21 DR. KINGHAM: We recognize the
22 difficulty this imposes on everybody. The data were
23 available and Mr. Crutcher or Mr. Petrie had an
24 opportunity to review it last night and I don't think
25 we have any difficulty with that on the sheets and



1 that has been established and I understand everybody
2 recognizes it for what it is. There is a problem with
3 the large exhibits and the point is well taken that
4 there have been many of them throughout this hearing.
5 I guess the difficulty we would have is if the witness
6 was asked to comment on the significance of the
7 corrections made unless the witness has the opportunity
8 to satisfy himself that those corrections in fact
9 correspond to the information that has already been
10 presented, and that is the sort of thing we would be
11 looking to see is adhered to. We understood you to say
12 that you would not be taking this much further and
13 this was rather a way of introducing the corrections
14 to the data and on that basis I think we can accept it.

15 MR. HODGSON: I have a little difficulty
16 with the word "significance" because I don't intend to
17 press the witness in any way but I did intend to have
18 the witness point out to the Board that assuming the
19 data density corrections have been made correctly and
20 assuming they are plotted correctly that they do show
21 some changes in directions of gradient at some
22 piezometers. The reality is that I am happy to put
23 these in evidence now and deal with them tomorrow if
24 that makes it easier for anybody. It makes not a whiff
25 of difference to me, but I did want the opportunity to



1 correct what I think was -- I'm sorry, introduce what I
2 think was a needed modification to the evidence you
3 have and I don't want to make a whole lot out of it
4 other than just to introduce it. I would point out
5 that it's true that my witnesses in chief missed this,
6 but it also happens so did Mr. Estrin's and so did
7 Mr. McQuaid's. All the hydrogeologists in this
8 hearing, and Mr. Feenstra missed the density correction
9 and now he has picked it up and we now have it in
10 evidence where it belongs. I'm sorry it's so late in
11 the day but it's here and it's appropriate I believe...

12 DR. KINGHAM: I don't think the argument
13 was not with the evidence being in place but the
14 question of the extent to which you intend to use it
15 before the witness has an opportunity to satisfy
16 himself that the transposition of the numbers from H-
17 684 have been done correctly onto the chart.

18 MR. HODGSON: If I could have your
19 permission to introduce the other two cross-sections
20 and then we could leave it until tomorrow and I think
21 that would be satisfactory.

22 DR. KINGHAM: Very well.

23 --- EXHIBIT NO. H-685: Chart - Measured
24 Potentiometric Levels of
25 Cross-Section A-A



1 --- EXHIBIT NO. H-686: Chart - Potentiometric
2 Pressures Corrected for Water
Density on Cross-Section A-A

3 MR. HODGSON: I have two other cross-
4 sections for you. Could we mark the measured
5 potentiometric levels of cross-section A-A as Exhibit
6 H-685 and the potentiometric pressures corrected for
7 water density on A-A is H-686, the potentiometric
8 levels as measured on cross-section B-B as H-687 and
9 the potentiometric pressures corrected for water
10 density on cross-section B-B as Exhibit H-688.

11 --- EXHIBIT NO. H-687: Chart - Potentiometric Levels
12 Measured on Cross-Section B-B

13 --- EXHIBIT NO. H-688: Chart - Potentiometric
14 Pressures Corrected for Water
Density on Cross-Section B-B

15 MR. HODGSON: I don't know, but I have a
16 feeling we are going to make it to 1000 yet.

17 MR. LANCASTER: You are trying hard.

18 MR. CRUTCHER: Can we take these two
19 down?

20 MR. HODGSON: I think we can take the
21 others down now.

22 DR. KINGHAM: While we are considering
23 this, Mr. Crutcher, or rather Mr. Petrie -- it seems
24 its infectious -- you have had a chance to look at the
25 numbers before and can you tell us that where the
corrected gradients don't change from the uncorrected



1 | gradients but the corrected head is different, and I
2 | would draw your attention, say, to HC10, and is that a
3 | question of significant digits? Given the well screen
4 | difference and the pressure head difference it doesn't
5 | make a discernable difference?

6 | MR. PETRIE: I have not reviewed the
7 | document in detail, but it is my expectation from
8 | looking at piezometer 10-85 for piezometer 1 for
9 | example the uncorrected head is 93.02 and the corrected
10 | head is 93.06 and that four-centimetre change over the
11 | vertical increment defined by piezometers 1 to 2
12 | arrives at the same gradient and, yes, I suspect it to
13 | be a function of decimal places.

14 | DR. KINGHAM: Thank you. Thank you,
15 | Mr. Hodgson.

16 | MR. HODGSON: Q. Mr. Petrie, going back
17 | to page 112 of B-617. We discussed in the previous
18 | paragraph the steep downward gradients on site.

19 | MR. PETRIE: A. Yes.

20 | Q. The discussion of those gradients
21 | continues in this paragraph and the next paragraph:

22 | "Consideration of these gradients..."
23 | I take it that you mean the steep downward gradients on
24 | site?

25 | A. I do.



1 Q. "... indicates that the site is
2 'underdrained'. In such a system, a
3 higher permeability zone or zones exists
4 at depth which acts to drain the
5 overlying rock and provides a means for
6 the lateral flow of this water away from
7 beneath the site. The position of such
8 a drain or drains lies at or beneath the
9 deepest on-site piezometers at which the
10 steep downward hydraulic gradients are
11 encountered; specifically, HC3, HC4,
12 HC5, HC6, HC7 and HC8."

13 You will recall that HC7-85 is over near King Road?

14 A. It is to the east of the other
15 ones.

16 Q. I want to explain that is why we
17 have left it off H-668 because we discussed in plan
18 view yesterday it constitutes the piezometers that are
19 in fact installed in boreholes which are more or less
20 on Site F.

21 A. I believe you mean that HC7 is to
22 the far east on the property and not on the directly on
23 the proposed landfill ...

24 Q. To the far east.

25 A. In the far east?



1 Q. That was your expression and I was
2 adopting it and I think it is appropriate. Am I right
3 going back to the second sentence, what you are telling
4 the Board is that it wouldn't be possible for the steep
5 downward gradients to exist on Site F if there were not
6 an underdrain system?

7 A. That is my idea, yes.

8 Q. That is a simple principle of
9 hydrogeology, if there are steep downward gradients
10 there has to be something underneath that is draining
11 the system?

12 A. In a general sense, yes.

13 Q. Any hydrogeologist who finds steep
14 downward gradients immediately says to himself
15 something must be underdraining the system because I
16 have steep downward gradients and isn't that what a
17 hydrogeologist says to himself?

18 A. I can't speak for all
19 hydrogeologists.

20 Q. Isn't that what you say to
21 yourself?

22 A. That's what I say to myself and
23 it's something I would consider in evaluating a site
24 with steep downward gradients.

25 Q. Forgetting for a moment any



1 discussion about where that underdrain may be, this is
2 something that your interpretation as presented here on
3 page 112 has in common with Mr. Sobanski's
4 interpretation, does it not? You both agree that Site
5 F is underdrained?

6 A. Yes. You qualified your sentence
7 by saying ignoring where that underdrain is, and in a
8 general sense we are in agreement.

9 Q. Mr. Sobanski says there is an
10 underdrain to the system and you say there is an
11 underdrain to the system. If you have a difference on
12 that subject it's a difference of deciding where it is
13 that that underdrain might be?

14 A. Where and the hydraulic properties
15 of that drain.

16 Q. Would you agree with me,
17 Mr. Petrie ...

18 A. Excuse me and could I add one
19 other qualifier and I'm sorry to interrupt. I note it
20 may be zone or zones and I believe Mr. Sobanski has
21 one and I'm not sure of that but one or more.

22 Q. We are clearly on the same
23 wavelength because you have given me the answer and I
24 didn't ask the question.

25 A. I would appreciate if you would



1 ask the question to be sure.

2 Q. The question to which I now would
3 require an answer ...

4 MR. GARROD: What is the plural of zone?

5 MR. HODGSON: Q. The answer is that
6 there could be more than one underdrain?

7 MR. PETRIE: A. They would all comprise
8 the underdrain, yes.

9 Q. But there could be more than one
10 zone to the underdrain?

11 A. There could indeed.

12 Q. There could be several zones?

13 A. There could.

14 Q. There could be some much deeper
15 than others?

16 A. I don't know what you mean by
17 "much."

18 Q. Thirty metres?

19 A. Thirty metres, greater than 30
20 metres? The difficulty with that -- something strikes
21 me as intuitively wrong with having it very deep and
22 the sort of thing that comes to mind when you say that
23 is that you have the ultimate discharge from the system
24 which is probably Lake Ontario and the pressure head --
25 the water level of Lake Ontario must exert some balance



1 within the system and if you had those drains very,
2 very deep, something strikes me as a bit inconsistent.

3 Q. So now I have a second answer to a
4 question I didn't ask. Please put up the cross-section
5 and we can explore the answer you have given. Put up
6 the cross-section we marked on the first day of my
7 cross-examination, a regional cross-section B-B with a
8 bunch of rock elevations on it.

9 MR. GARROD: Six forty-five.

10 MR. PETRIE: I have not filed these ones
11 in order up here. I'll just clip it up a little
12 higher. I have run out of big clips.

13 MR. HODGSON: Q. Is it possible for you
14 to give the Board a relative level of the water surface
15 at the lake?

16 MR. PETRIE: A. You have indicated on
17 Exhibit H-645 the lake, and I believe that is my
18 writing, 67 metres above sea level.

19 Q. That actually is the rock level.

20 A. I beg your pardon, it is. I am
21 noting on the right-hand side of the figure it looks
22 like approximately 70.

23 Q. Approximate is fine, but we are
24 talking about principles. Could you put a V notch at
25 70 and write "70" for lake?



1 A. A V notch like what? I missed
2 your finger. I just saw your hand move and I didn't
3 appreciate what you meant.

4 Q. I have drawn a V intersecting what
5 appears to be the lake level on H-645.

6 A. Yes, it appears to be that.

7 Q. Could you mark in there "lake
8 surface 70 metres"? I think I'll get confused if we
9 concentrate on the lake so could we refocus for a
10 moment on HC11? The bedrock level at HC11 is 79
11 metres?

12 A. As we have indicated on H-645,
13 yes.

14 Q. Supposing there was water that was
15 migrating out of the NSP lands without a landfill and
16 let's deal with water and not worry about leachate for
17 a minute, but water that is migrating vertically
18 downward through that rock. In order for that water to
19 have the ability to resurface at the bedrock contact at
20 HC11, it would have to have a piezometric pressure that
21 exceeded 79, would it not?

22 A. By a small or large amount -- I'm
23 sorry, HC11, I have lost it. Yes.

24 Q. If you wanted to drive that water
25 not out of the bedrock surface but at the earth



1 surface, how much higher must we go for that?

2 A. It depends upon what portion of
3 the earth surface you are referring to.

4 Q. At the top of the piezometer at
5 HC11 and what is the level, give or take?

6 A. I believe about 90 metres.

7 Q. In order to have water from
8 upstream that will be driven out at HC11 it would have
9 to have a piezometric pressure that exceeded 90 metres?

10 A. Correct. I would point out that
11 adjacent to HC11 we have the creek, and I don't recall
12 the dimensions of the creek or the base of the creek,
13 but in my walking of it it is some depth below HC11 so
14 there are ground surfaces lower in the area of HC11
15 than indicated by the ground surface at HC11.

16 Q. We are talking principles and I
17 don't care what ground surface you pick. At any given
18 ground surface in order to have water emerge at that
19 ground surface you must have enough head to drive the
20 water out at that level.

21 A. I agree with that.

22 Q. If the level of the ground surface
23 is 70 metres you need 70 metres plus of head and if
24 it's 80 metres you need 80 metres plus of head?

25 A. Correct.



1 Q. To go back to what you said
2 earlier if we ask ourselves the question "Where is the
3 underdrain on Site F?", if the underdrain on Site F is
4 below 79 metres and there isn't a lot of water pressure
5 in the underdrain, then there won't be enough pressure
6 to drive that water out at the bedrock contact at HC11?

7 A. If the underdrains are below 79
8 metres and there won't be enough pressure to drive it
9 out at HC11. That would depend upon the lateral
10 permeability within the underdrain system. If it was a
11 high pressure head at one end of the underdrain system
12 and very little impedance to that flow through the
13 underdrain system, the drain could be at a lower
14 elevation but you would have upward gradients at the
15 discharge. You are putting water into a pipe under
16 pressure and it's squirting out at the other end under
17 pressure. That is quite an exaggeration, but I'm just
18 indicating that it is in part dependent on the pressure
19 loss laterally through the underdrain system.

20 Q. I accept that in fact in order to
21 drive the water out at 79 metres of elevation you would
22 need underneath the site a water pressure that was 79
23 metres plus whatever additional head you needed in
24 order to have enough energy to drive the water from
25 where it was under the site all the way down the system



1 to HC11?

2 A. That is correct.

3 Q. We are talking about enough energy
4 to move water through the system.

5 A. That is correct.

6 Q. Now, if we have -- to go back,
7 when you were saying "Intuitively I don't want to have
8 the underdrain too low," and those aren't your exact
9 words, but you said intuitively you couldn't imagine
10 the underdrain too low and you were talking about the
11 fact you assumed all this water is headed towards Lake
12 Ontario and it won't get to Lake Ontario if the drain
13 is too low because there won't be enough pressure down
14 there to move it laterally towards Lake Ontario?

15 A. No. The deeper you have -- the
16 deeper the drain then the more pressure loss you would
17 have in driving water down to the drain and still
18 ignoring the pressure loss laterally within the drain
19 you should still be able to push it up the other end
20 and when you were asking me if it could be 30 metres
21 plus deep, I thought there was something inconsistent
22 in that. I imagine there has to be some physical
23 limits on the depth to which that drain could
24 physically exist, but those limits are in part
25 dictated by the vertical permeabilities in the system



1 which I do not have a measure of and the lateral
2 pressure loss through a drain system and again I do not
3 have a measure of that.

4 Q. Mr. Sobanski thinks that he has
5 detected an underdrain in what he has called his highly
6 fractured zone which is the lower zone on H-668 -- not
7 the lower zone but could you indicate for the Board
8 roughly where the highly fractured zone is?

9 A. I am assuming you are referring to
10 these horizontal dashed lines approximately between 100
11 metres and 110 metres of elevation and you are saying
12 that is Mr. Sobanski's highly fractured zone?

13 Q. Yes. Would you agree with me that
14 assuming for a moment Mr. Sobanski is right, that he
15 has found a more permeable zone there capable of moving
16 water laterally?

17 MR. McQUAID: I object to that. You
18 can't put a question which assumes something which is
19 one of the major issues in the hearing. It's not a
20 fair question. The witness has taken issue with it and
21 he doesn't agree so you can't ask him to assume so.

22 MR. HODGSON: I can't put a hypothetical
23 question to an expert witness?

24 MR. McQUAID: Assuming what Mr. Sobanski
25 has said ...



1 MR. HODGSON: I didn't say "Assume there
2 was a highly fractured zone" but I said "Assume he has
3 identified one zone, a more permeable zone capable of
4 moving water laterally" and the rest of the question
5 which was interrupted, thanks to Mr. McQuaid, was can
6 the witness tell us whether or not it is possible even
7 if he can make that assumption, that there could also
8 be other more permeable zones beneath that zone. That
9 is the question. So now you can rule on it.

10 MR. LANCASTER: That question is all
11 right, yes. It is differently phrased.

12 MR. PETRIE: Could I ask that you repeat
13 it, I'm sorry?

14 MR. LANCASTER: The second time, not the
15 first.

16 MR. HODGSON: Q. Mr. Sobanski believes
17 he has identified a more permeable zone in that zone
18 you indicated on H-668. Assuming for the moment that
19 Mr. Sobanski is correct that there is a more permeable
20 zone there, would you agree it's also possible there
21 could be other more permeable zones below it?

22 MR. PETRIE: A. There could be, yes.

23 Q. In fact if there are other more
24 permeable zones below it, that would not be consistent
25 with Mr. Sobanski's evidence that that particular zone



1 is more permeable?

2 A. I thought that was a contradiction
3 in terms.

4 Q. Just because Mr. Sobanski says
5 there is a more permeable zone between 100 and 110
6 metres does not rule out the possibility there is
7 another one below it?

8 A. Correct.

9 Q. If there is another one below it
10 that would explain why we still have steep downward
11 gradients across that zone on Exhibit H-668?

12 A. It could explain that.

13 Q. However if we have -- let's just
14 pick a notional level. If we have a more permeable
15 zone below the deepest piezometer which is at HC8-85;
16 the deepest piezometer is at HC8-85?

17 A. Of the ones you have coloured in
18 on 668, yes.

19 Q. That piezometer goes down to
20 approximately 87 metres, is that fair?

21 A. Eyeballing this exhibit, yes.

22 Q. Suppose there was a more permeable
23 zone between 80 and 84 metres above sea level. Would
24 you agree with me that in order to drive water or
25 leachate or whatever was in that more permeable zone



1 laterally and have it emerge at HC11, we would have to
2 have enough head in that system to drive it laterally
3 and have it come up at bedrock surface at HC11?

4 A. Yes.

5 Q. And in fact isn't it the case that
6 the lower the permeable zone the less likely it is we
7 will have enough head to move the leachate and have it
8 surface somewhere in Aldershot?

9 A. The lower the permeable zone the
10 less likely it could provide the conduit for the upward
11 gradients beneath Aldershot?

12 Q. Yes.

13 A. Yes.

14 Q. Would you not agree with me then
15 that it is conservative to interpret Site F as having a
16 more permeable zone at a higher rather than merely a
17 lower elevation?

18 A. When you say a more permeable zone
19 I believe you are implying a zone of the dimensions
20 Mr. Sobanski has indicated.

21 Q. I'm sorry, could you repeat that?

22 A. Yes. When you are referencing a
23 more permeable zone I believe you were implying
24 something of the order of the dimensions Mr. Sobanski
25 has indicated.



1 Q. Yes.

2 A. I have not indicated the
3 dimensions of a zone in any fashion as I recall. I
4 have difficulty envisioning a ten-metre zone, a lot of
5 difficulty, and what I had in mind when I wrote this
6 was that the zones might be quite discrete, quite thin
7 and it might not necessarily have continuity in every
8 place and you might not have a good handle were you to
9 drill through them that indeed you have such a zone
10 unless you set a zone at that elevation. We were
11 looking at zones of a half a metre thick with
12 relatively high hydraulic conductivities and I believe
13 you would have some difficulty in delineating those
14 zones.

15 Q. Mr. Petrie, would you agree with
16 me that we know that Site F has an underdrain and that
17 is your evidence and Mr. Sobanski's evidence?

18 A. Yes.

19 Q. That's pretty good evidence.

20 A. It is an opinion based on the
21 gradients.

22 Q. I appreciate that. It's your
23 opinion and Mr. Sobanski's opinion so you have no
24 trouble in addressing this. Your opinion is that we
25 have an underdrain to that system?



1 A. Correct.

2 Q. What I suggested, Mr. Petrie, was
3 that if there is an underdrain to that system, for
4 purposes of understanding Site F it doesn't really
5 matter exactly at what elevation that underdrain is
6 since we know there is an underdrain?

7 A. There are a number of qualifiers
8 to answer that. One ought to know where the drain is
9 because presumably one will try and characterize the
10 hydraulics of it to be able to monitor and so I do not
11 believe I can agree with your question. If you are
12 understanding the site and the intention of
13 understanding with respect to a landfill investigation,
14 you understand it so you can categorize the hydraulics
15 of each zone of concern and you can define those zones
16 in space, i.e., the elevation and continuity, and
17 therefore you can focus your monitoring program or
18 additional investigations if so required on to those
19 zones. I don't know what you mean by conservative in
20 that context.

21 Q. Let me come back to that point.
22 What I would first like you to tell us is why does it
23 matter, and let's take some notional distinctions.
24 Mr. Sobanski says there is a drain between 100 and 110
25 and let's suppose we take that as one possibility and



1 take as a second possibility that there is a drain
2 between 90 and 95 and then take a third possibility
3 that there was a drain between 80 and 85.

4 A. Can I write these down, please?
5 Option No. one is 100 to 110 and two is 90 to 95 and
6 three was ...

7 Q. ...80 to 85 metres.

8 A. I have that.

9 MR. McQUAID: Just a moment, I want to
10 object. If Mr. Hodgson is saying take the assumption
11 that they are there, then I would like the opportunity
12 to bring the authority to the fact that you cannot put
13 to a witness as an assumption one of the main issues
14 that the Board is to decide upon. There is a
15 difference of opinion as I hear Mr. Petrie's evidence
16 and Mr. Sobanski's evidence over whether there is such
17 a zone of ten metres or five metres or whatever it
18 might be and you can't turn around and say to the
19 witness "I want you to assume my witness is correct"
20 and then go off on cross-examination and I will bring
21 you authority to that effect in the morning and I am
22 objecting to that question with those assumptions.

23 MR. HODGSON: I didn't ask him to assume
24 my witness was correct. I am asking him a hypothetical
25 question which is we have three possible locations for



1 an underdrain, hypothetical locations for an
2 underdrain, and I want his evidence and his explanation
3 to you as to why it makes any difference to your
4 ability to decide whether or not it is appropriate or
5 inappropriate to build a landfill at Site F what the
6 vertical elevation of that drain is. I want to know
7 what the difference is between a drain at 80 to 85 and
8 90 to 95 and 100 to 110. What difference does it make
9 what elevation it's at since we know that it's down
10 there somewhere and since it has to be down there in
11 order to account for those vertical gradients? That is
12 the explanation I would like him to give to you.

13 DR. KINGHAM: It's our understanding
14 that the witness has already stated that it is his
15 interpretation of the hydrogeology that the area is
16 underdrained and that was the point of departure before
17 the discussion. I guess the difficulty is with a
18 reference to assuming Mr. Sobanski is correct. It is
19 my recollection you have used that phrase a number of
20 times. It would be easier for the Board to deal with
21 the matter if your questions were phrased based on
22 Mr. Petrie's statement that it is underdrained by a
23 zone or zones and then pursue it on the basis of
24 Mr. Petrie's own evidence.

25 MR. HODGSON: I was actually thinking



1 and reading the report while I was waiting for you to
2 rule, but I realize I have another way to ask this
3 question and I don't think I have a problem but it
4 finesses the problem in any case so may I try it?

5 MR. GARROD: I wonder if I could make a
6 submission before Mr. Hodgson does that. I felt I had
7 to rise because although I am not particularly
8 concerned about this point there are certainly two
9 points I would like to address. First of all, in my
10 experience I don't know of any reason why one can't ask
11 a hypothetical question of a witness to assume that
12 somebody is right in an opinion that that witness does
13 not agree with and then go on to follow the
14 implications and I see nothing wrong with that.
15 Mr. McQuaid says that is wrong if that is a fundamental
16 question this Board must answer. Be that as it may at
17 the moment, I don't see it as a question before this
18 Board as to whether or not a zone of high permeability
19 underlies this site in a particular location and that
20 is not the fundamental question before the Board. The
21 fundamental question is whether one should be
22 landfilling at Site D or Site F and it may be a small
23 part of that inquiry, whether or not that zone exists,
24 but that is not the question before the Board and I
25 don't think that it flows automatically one way or the



1 other from the answer to that question whether or not
2 it is suitable to landfill at Site F.

3 MR. LANCASTER: In any event,
4 Mr. Hodgson, you may pursue it.

5 MR. HODGSON: Q. We have Mr. Sobanski's
6 evidence that there is an underdrain between 100 and
7 110 metres and we have your evidence at the bottom of
8 page 112 that the position of such a drain or drains
9 lies at or beneath the deepest on-site piezometers.
10 Now, the deepest on-site piezometer is HC8-85 and that
11 means that the drain or your evidence is that the drain
12 is either at approximately 87 -- let's get that right.
13 What is the level of the lowest piezometer in HC8 at
14 the bottom of the borehole?

15 MR. PETRIE: A. Using the scale on
16 H-668 it looks like approximately 87 metres.

17 Q. Eighty-seven metres?

18 A. Correct.

19 Q. Now, you say there is a drain at
20 87 metres or below 87 metres and Mr. Sobanski says
21 there is a drain between 100 and 110 metres. Does it
22 make any difference if you are both right?

23 A. I have difficulty in answering
24 that in the sense that if we are both right are you
25 implying that the hydraulic characterization of that



1 drain is also the same as Mr. Sobanski's?

2 Q. Mr. Petrie, I am not talking about
3 hydraulic characterization. You said there was an
4 underdrain and I'm asking you does it matter where it
5 is and does it matter whether it's at the bottom of HC8
6 or between 110 and 100? What difference should it make
7 to this Board in deciding whether or not it's
8 appropriate to landfill at Site F where that underdrain
9 is? I'm asking you to concentrate on that underdrain
10 and not go off into any other irrelevancies or repeat
11 all your other evidence in chief. I want to know if it
12 matters what level that underdrain is at.

13 MR. McQUAID: The lecture is completely
14 uncalled for. He has asked a question and the witness
15 had the difficulty I had and that is can both witnesses
16 be right?

17 MR. HODGSON: You shouldn't presume what
18 difficulty the witness had. You can express your
19 difficulties.

20 MR. McQUAID: Counsel is not entitled to
21 berate the witness. The witness was trying to
22 understand the question which was basically does it
23 make any difference if you are both right and that
24 assumes that both are right and then the question of
25 course or the foundational question is can both be



1 right? I don't know if it can or can't, but the
2 witness was trying to think and answer the question and
3 then he gets a lecture.

4 MR. LANCASTER: I think the witness was
5 entitled to a clarification.

6 MR. McQUAID: Exactly.

7 MR. LANCASTER: Mr. Hodgson, I think we
8 are going to take our break now.

9 --- Recess

10 MR. LANCASTER: Please be seated.

11 MR. HODGSON: Q. Over the break I
12 thought of one question I think I can ask you without
13 upsetting Mr. McQuaid. Mr. Sobanski has said there is
14 a more permeable underdrain to the system between 110
15 and 100 metres. You say that that more permeable
16 underdrain lies somewhere below 97 metres.

17 MR. PETRIE: A. I didn't say 97.

18 Q. I haven't asked my question, so
19 please don't start your answer.

20 MR. McQUAID: It's a misstatement so
21 there is no point continuing with the rest of the
22 question.

23 MR. PETRIE: You said 97 metres.

24 MR. HODGSON: Q. I'm sorry, it's 87
25 metres. So below 87 metres. Assume Mr. Sobanski is



1 wrong and you are right, tell the Board why it makes
2 any difference.

3 MR. PETRIE: A. During the break I
4 reflected on this statement I have at the bottom of 112
5 and the top of 113. The intent I had in producing that
6 is that in the depth above the deepest piezometer I
7 cannot rationalize that a highly fractured zone has
8 been defined. I am therefore suggesting that the
9 position of these zones or zone is really unknown and
10 cannot be defined. Your question is if it is below 87
11 metres what difference does it make and my response to
12 that is that the position of that drain was integral as
13 I understand it in Trow's assessment of the
14 hydrogeology of the site and if the position of that
15 drain is unknown, then I am of the opinion that the
16 site is ill-defined with respect to its hydrogeologic
17 characterizations which impacts the modelling
18 undertaken and which impacts the design options
19 considered and which impacts on the monitoring program
20 proposed and which impacts on the contingency options
21 considered and it has a big significance if the
22 position of that drain is or cannot be defined.

23 Q. Now I would like an answer to my
24 question.

25 A. I believe I did answer your



1 question.

2 Q. I believe you avoided it. Tell
3 me, please, and tell the Board why it makes any
4 difference?

5 MR. McQUAID: You can re-ask the
6 question but what Mr. Hodgson's belief is, he can ask
7 the Board for a ruling, but if the witness says he has
8 answered the question the Board must take that and
9 that's it really.

10 MR. HODGSON: My friend Mr. McQuaid is
11 being a good sport in interrupting this cross-
12 examination and the flow of this cross-examination at
13 every opportunity. I asked a very direct and simple
14 question and I didn't hear an answer and I'm asking the
15 question again and I'm asking for an answer.

16 MR. LANCASTER: He answered it his way-
17 so you can ask it again to get the answer you wanted.

18 MR. HODGSON: Q. I asked you to assume
19 that Mr. Sobanski was wrong about where the underdrain
20 was and I asked you to assume that you are right. You
21 have no difficulty assuming you are right?

22 MR. PETRIE: A. It depends upon what
23 statement you are referring to in assuming I am right.

24 Q. Your statement is:

25 "The position of such a drain or drains



1 lies at or beneath the deepest on-site
2 piezometers at which the steep downward
3 hydraulic gradients are encountered;..."

4 And that is your sentence?

5 A. It is and I indicated to you a
6 moment ago that during the break I reflected on that
7 and it is my position that above that elevation, and we
8 are specifically referring to 87 metres, I do not
9 believe a zone has been defined. I ought to have
10 prefaced that sentence by saying if the zone exists
11 above that elevation it has not been defined and I do
12 not know where the zone or zones are located.

13 Q. Mr. Petrie, your report says the
14 site is underdrained and your report says:

15 "The position of such a drain or drains
16 lies at or beneath the deepest on-site
17 piezometers at which the steep downward
18 hydraulic gradients are encountered;..."

19 Does it or does it not say those words?

20 A. I agreed it does say those words.

21 Q. Thank you.

22 A. I also intimated that I had
23 reflected on those words such that were this drain
24 which I believe cannot be defined to lie above the
25 elevation of the lowest piezometer, and we are



1 referencing an elevation of 87 metres, it has not been
2 defined.

3 Q. I'm not asking you about what has
4 not been defined but I am asking you what you have said
5 in your report. You said the site is underdrained and
6 the drain lies:

7 "...such a drain or drains lie at or
8 beneath the deepest on-site piezometers
9 at which the steep downward hydraulic
10 gradients are encountered;..."

11 Now I think we all know where you are saying
12 approximately where there is an underdrain, but I am
13 asking you to focus your attention on this question;
14 assume your statements are correct, you don't have any
15 problem assuming your own statements are correct, do
16 you?

17 A. I indicated before that I had
18 reflected on that through the break and the position of
19 that zone or zones may straddle that interfacing.

20 Q. Do you want to assume your
21 statements are false?

22 A. My statement is not false but I am
23 expanding.

24 Q. What is your statement?

25 A. I have repeated it twice and I



1 will repeat it again. The zone or zones above an
2 elevation of 87 metres has not been defined. Were the
3 zone to lie in that elevation above 87 metres it has
4 not been identified.

5 Q. That has nothing to do with your
6 statement.

7 A. I have indicated to you that I had
8 reason to reflect over the break and that statement
9 could be expanded to indicate that the zones do not
10 necessarily have to lie beneath the elevation we have
11 referenced as 87 metres.

12 Q. You are saying it could be above
13 87 metres?

14 A. I have indicated a plural zone or
15 trends such that some could lie above and some below.

16 Q. I accept that.

17 A. Thank you.

18 Q. Let's assume you are correct in
19 that statement and that's a modification of the
20 statement in the report but I will accept that
21 modification so let's assume you are correct.
22 Mr. Sobanski has said the zone lies between 100 and 110
23 metres and you have said something slightly different
24 and that it lies somewhere below that and you have told
25 us in a highly qualified statement approximately where



1 you are thinking about. Now, for the purposes of my
2 question I'm not trying to pin you down to 91 metres or
3 87 metres, 82 metres or 99 metres, I don't care. Your
4 zone is below Mr. Sobanski's zone and I'm asking you to
5 focus on this aspect and this aspect alone. Tell me,
6 why does it make any difference whether it is deeper?

7 A. First off your comment with
8 respect to my zone is below Mr. Sobanski's zone. I
9 cannot define the zone and I have indicated it does not
10 have to be. With respect to the second point of your
11 question, what difference does it make, it is very
12 significant. If the zone is not defined I cannot
13 understand how you can monitor the site. I notice that
14 a contaminant flow pathway has been defined as
15 traversing this zone and obviously how do you monitor
16 it and how do you implement contingency options,
17 provide for predictions with respect to the performance
18 of this site for proposed landfilling? That is the
19 most significant difference.

20 Q. I'm sorry, I still don't think I
21 have heard an answer to my question. Why does the
22 location -- let me ask it again and let me listen to
23 your answer. Why does the exact location of the
24 underdrain or underdrains, since we have your opinion
25 that there is one or some and we have Mr. Sobanski's



1 opinion on that, why does the exact location make any
2 difference to this Board's ability to approve Site F or
3 find it suitable for landfilling? I am just focusing
4 on the location and the location only. Why does the
5 location matter?

6 A. The location is a contaminant flow
7 pathway as defined by Mr. Sobanski and if you do not
8 know where that pathway is or its hydraulic properties,
9 it is my opinion that the site is ill-defined and that
10 impacts on all deliberations regarding suitability for
11 landfilling.

12 Q. Mr. Sobanski has defined a
13 contaminant flowpath and you say it's not where he said
14 it is but you say there is an underdrain deeper;
15 correct?

16 A. We went through this before and I
17 said the zone may not be below 87 but I did not give
18 you an elevation and you are telling me I am saying
19 it's deeper.

20 Q. Are you not telling me it's
21 deeper?

22 A. I don't know where the zone is.

23 Q. Does it matter where the zone is?

24 A. I indicated to you it matters very
25 much.



1 Q. Let's walk through and find out
2 exactly why it matters very much where it is. Tell me
3 the answer again. Why does it matter where it is?

4 A. Because one has to be able to
5 define it in space and its hydraulic characteristics in
6 order to undertake any assessment of the suitability of
7 the site for landfilling. Mr. Sobanski has defined
8 that zone as being one of his contaminant pathways and
9 I believe he defined it as the only one in his
10 estimation that provided for off-site groundwater flow.
11 If we do not know where the zone is, then I suggest and
12 would repeat to you that the site is ill-defined in its
13 hydrogeologic characteristics and that ought to impact
14 in my opinion on the assessment of the suitability of
15 this site.

16 Q. Let's take a hypothetical. Let's
17 assume -- no, let me think about this for a moment.
18 First of all, are we in this situation; Mr. Sobanski
19 says he has identified a contaminant flow pathway
20 between 100 and 110 metres and you say he hasn't but
21 you agree that somewhere down there there is a
22 contaminant flowpath. Is that correct?

23 A. Correct.

24 Q. Does it make any difference
25 exactly at what elevation it is as long as at some



1 point it is identified so it can be monitored?

2 A. In identifying the zone one would
3 also have to identify its hydraulic characterizations
4 but I agree. Could you define the zone and define its
5 hydraulic characteristics, then you are in a position
6 to undertake an assessment regarding the significance
7 of that zone and if you could define the zone I also
8 suspect you could monitor the zone or you could if one
9 wished. I'm not suggesting one should, but one could
10 model the site in some fashion or Mr. Sobanski would be
11 in a better position to model the site if the zone was
12 defined, yes.

13 Q. So you think there is a
14 contaminant pathway down there and your evidence is
15 that it is important that we identify where it is and
16 we identify what its characteristics are. Focusing for
17 a moment not on what its characteristics are but where
18 it is, does it make any difference if it's at 105
19 metres or at 100 metres or 80 metres? Does it make any
20 difference in terms of the impact on the area south of
21 the landfill site?

22 A. The travel times to that zone and
23 through that zone are what one uses to evaluate an
24 impact. If you are telling me you don't know where the
25 zone is then I don't understand how you can complete



1 that assessment.

2 Q. I'm not telling you anything. I
3 asked you to draw ...

4 A. You wanted me to conceptualize a
5 hypothetical question.

6 Q. I wanted you to hold constant any
7 concern about its hydraulic characteristics and focus
8 simply on its geographical definition in space. Does
9 it matter for the purposes of impact south of 403 where
10 in vertical elevation the contaminant pathway is?

11 A. Yes.

12 Q. How?

13 A. Because flow has to reach that
14 pathway in some fashion and the length of that flowpath
15 impacts on the deliberations of the assessment of the
16 site.

17 Q. Thank you. Contaminants have to
18 reach the pathway?

19 A. Correct.

20 Q. If the pathway is deeper than
21 Mr. Sobanski says it is, then do you agree that in all
22 likelihood it will take contaminants longer to reach
23 it?

24 A. Holding all other constants --
25 other variables constant, then the length of the



1 flowpath will lead to a length in the travel time, yes.

2 Q. There is more matrix of rock
3 through which the contaminants must travel?

4 A. If it's travelling through the
5 matrix.

6 Q. If it's travelling through the
7 fractures there are more fractures it has to travel
8 through?

9 A. Correct, although realizing that
10 the fracture velocities could be very high and where
11 fractures are continuous, a few metres longer in travel
12 path may not have much significance with respect to the
13 time taken, but that would have to be evaluated.

14 Q. Other than the travel time and
15 whatever effect it has on the travel time to get to the
16 contaminant pathway, do you agree it makes no
17 difference where it is in vertical elevation?

18 A. You would still have to be able to
19 monitor it and assess it and if you don't know where it
20 is then that is my argument. If you don't know where
21 the zone is ...

22 Q. No, no. I appreciate that point,
23 but I am assuming that it can be found and I am
24 assuming for the moment because you want your evidence
25 to be that it hasn't been found that it hasn't been



1 found but my question is, assume it can be found. Now,
2 does it matter where we find it in terms of its
3 vertical elevation? If it turned out to be at 105 or
4 100 or 87, does it make any difference in terms of
5 impact south of 403 at what vertical elevation, other
6 than what you have already told us which is the travel
7 time down to that contaminant pathway?

8 A. I don't believe I can answer that
9 question. It is significant with respect to the site
10 and you are asking me to assume something and I have
11 difficulty following that right through and my answer
12 would probably be speculative. I do not know what
13 difference it would have and I would have to spend some
14 time deliberating it. If you can define a zone for me
15 I could undertake an assessment of that and then tell
16 you what difference it made, but I am not the proponent
17 of the site, Mr. Hodgins.

18 Q. It's Hodgson.

19 A. Pardon. But I'm taking your
20 conceptualization and I'm not sure what difference it
21 would make, I do not know.

22 Q. Is it your answer that you don't
23 know what difference it would make how deep it is other
24 than the travel time to it? Is that your answer?

25 A. It is at this point in time and



1 it's a difficult question to assess.

2 Q. Looking at Exhibit H-668 and
3 taking your statement there:

4 "... drain or drains lie at or beneath
5 the deepest on-site piezometers..."

6 And the deepest on-site piezometer is HC8 and taking
7 your qualification that in fact it may lie above that
8 deepest level, would you agree that what we see at HC8
9 at the bottom of that piezometer is very high chlorides
10 and very low tritium?

11 A. Referencing H-659 the chlorides at
12 the bottom of HC8 are high and the tritium data is
13 indicated on Exhibit H-662 and the tritium values are
14 low.

15 Q. It doesn't suggest an active flow
16 zone at that location, does it?

17 A. Relatively, no.

18 Q. Now, reading on at page 113:

19 "The uppermost section of the bedrock is
20 generally weathered and fractured and,
21 as such, is expected to have a higher
22 hydraulic conductivity than the
23 underlying less weathered rock."

24 What we are working with is a conceptualization in
25 which we have an underdrain down deep somewhere and we



1 have an upper section of the bedrock that is weathered
2 and fractured and in between we have some less
3 weathered rock. Correct?

4 A. In a general sense, yes.

5 Q. Then you say:

6 "Less steep gradients were encountered
7 in this zone, ..."

8 That being the uppermost section of the bedrock?

9 A. Correct.

10 Q. "... indicating that it comprises
11 a pathway of lateral groundwater flow."

12 That sentence is almost identical to a sentence we read
13 exactly one page before and I think you would agree
14 with me that it isn't particularly accurate when we
15 look at where we see steep gradients on Site F?

16 A. The word "generally" is in there
17 and we are talking about the upper portions of the
18 rock.

19 Q. I don't see "generally" in the
20 sentence.

21 A. The first sentence of the
22 paragraph:

23 "The uppermost section of the bedrock is
24 generally weathered and fractured and,
25 as such, is expected to have a higher



1 hydraulic conductivity than the
2 underlying less weathered rock. Less
3 steep gradients were encountered in this
4 zone, ..."

5 That is a generally weathered and fractured upper zone
6 and that zone in general indicates:

7 "... it comprises a pathway of lateral
8 groundwater flow."

9 Q. Are you suggesting that this zone,
10 the uppermost section of the bedrock which you are
11 describing here, is this a contaminant pathway?

12 A. Were contaminants to be introduced
13 into that zone they would move laterally within it;
14 that is correct.

15 Q. Would they move under Highway 403?

16 A. It would depend upon the extent of
17 that zone.

18 Q. It would depend upon whether or
19 not it had any depth to it at all under Highway 403?

20 A. That is correct.

21 Q. We can come back and discuss that
22 tomorrow. Will you agree with me that this portion of
23 your statement:

24 "Less steep gradients were encountered
25 in this zone, ..."



1 And looking at H-668, that is not an accurate statement
2 and in fact in four out of five piezometers we find
3 steep gradients in the upper section of the bedrock?

4 A. Upper in my mind when I wrote that
5 is it at least extends to the base of the blue zones in
6 HC4 and HC3 and in HC6 and those blue zones are
7 indicated as you have noted on Exhibit H-668 has a
8 downward gradient of 0.1 and that is the less steep
9 downward gradient I am referring to. Now the generally
10 weathered and fractured rock in a general sense is
11 above those zones at those boreholes.

12 Q. So, did you say three boreholes,
13 HC3, HC4 and HC6?

14 A. I referenced three boreholes.

15 Q. Concentrating on three boreholes,
16 would you agree with me that your statement:

17 "Less steep gradients were encountered
18 in this zone, ..."

19 is in fact a zone below a zone where you have got very
20 steep gradients in all three of those boreholes, HC3,
21 HC4 and HC6?

22 A. At those locations there are
23 steeper gradients above it.

24 Q. We don't have any other locations
25 because those are the three locations you brought my



1 attention to and at those three locations you have very
2 steep gradients at the top of the bedrock?

3 A. Yes, and within what I am calling
4 this generally weathered and fractured zone there is
5 within that zone less steep downward gradients and
6 those portions of the rock to my mind describe or
7 delineate in some fashion potential lateral pathways.

8 Q. The lateral pathway is in the blue
9 zones and where we have the green and red we have
10 vertical movement?

11 A. We have vertical movement in all
12 zones.

13 Q. But the vertical movement is very
14 slow, is it not, because the gradients are very high
15 and suggesting very high permeability contrasts and
16 very low permeability material?

17 A. The gradients are steep suggesting
18 hydraulic conductivity contrasts, yes.

19 Q. On this table right in front of
20 you we have five boxes of very, very low permeable
21 material, don't you agree?

22 A. I agree that portions of those
23 rock mass were low permeable, yes.

24 Q. "However, the exact vertical
25 extent of weathered and fractured



1 bedrock mantle is unknown."

2 Now, how would we go about in a perfect world
3 delineating the exact vertical extent of weathered and
4 fractured bedrock mantle? What would we need to know
5 to delineate it?

6 A. We were looking at that fractured
7 bedrock mantle with respect to its hydraulic
8 characterization. It is my recollection that the
9 monitoring program proposed by Mr. Feenstra with its
10 quite extensive hydraulic testing could be employed to
11 undertake an evaluation of some form of this weathered
12 zone. In other words, and I'm trying to locate that
13 portion of Exhibit B-617, but page 86 provides the
14 comments as I have understood them from reading the
15 transcripts of Mr. Feenstra's evidence an ideally
16 starting at points 3 and 4 at the bottom of 86 and
17 continuing over to page 87:

18 "Core the deepest borehole at each well
19 nest.

20 Examine the core to identify zones of
21 fractures or discontinuities."

22 Q. Could we take them one at a time?

23 A. Yes.

24 Q. "Core the deepest borehole at each
25 well nest."



1 And that is what we did at each of the five boreholes
2 on the site?

3 A. Correct.

4 Q. "Examine the core to identify
5 zones of fractures or discontinuities."

6 That is what we did at the boreholes on the site?

7 A. Correct.

8 Q. Go ahead.

9 A. "Conduct down-hole packer tests to
10 define zones of high hydraulic
11 conductivity."

12 Q. That was done in three boreholes?

13 A. Portions of two boreholes and a
14 more extensive one at a third. The next one is not so
15 important:

16 "Instrument each of the high hydraulic
17 conductivity zones defined."

18 Q. Wasn't that in fact done and
19 didn't Mr. Sobanski use the Hvorslev tests to identify
20 -- didn't Mr. Sobanski, and I think it has already been
21 your evidence that Mr. Sobanski monitored the more
22 fractured zones in the boreholes he cored at this site?

23 A. As he defined them, yes.

24 Q. That is what you are saying in

25 No. 7?



1 A. Correct. No. 8:
2 "Conduct pumping tests to demonstrate
3 the degree of interconnection between
4 the fracture zones and the various
5 observation wells."

6 As I recall Mr. Feenstra's discussion regarding the
7 pumping tests and the packer tests, it was such that
8 one ought to isolate a fracture in one borehole and
9 monitor its response in another and one could do that
10 with a series of packers down the borehole or
11 instrument the boreholes, but it is my understanding
12 that the intention of that work was to demonstrate
13 fracture A in borehole A is connected to a certain
14 fracture in another borehole. In other words to be
15 able to demonstrate the lateral continuity of the
16 fractures within the various zones.

17 Q. We can discuss this tomorrow
18 because we have some evidence that was done at PW-1,
19 don't we?

20 A. You have provided me with more
21 evidence to that effect which I have yet to review.

22 Q. I provided you with a cross-
23 section and plotted up the data you already had and you
24 could have done that cross-section yourself; am I not
25 correct?



1 A. Most probably, but I haven't
2 reviewed the cross-section and evaluated all the data.

3 Q. Please continue.

4 A. That in essence was the program.

5 Q. If I suggest to you -- were you
6 finished?

7 A. I was, yes.

8 Q. The program you have just
9 described that should be carried out at this site was
10 in fact carried out at this site?

11 A. I disagree.

12 Q. Tell me exactly what it is that
13 wasn't done at this site which you say should have been
14 done?

15 A. It's not what was done so much as
16 what it led you to conclude. With that data ...

17 Q. Excuse me, but I asked the
18 question in a perfect world and how would you go about
19 doing it so don't go on to what was concluded from it.
20 Tell me how it can be done.

21 MR. McQUAID: You asked him a different
22 question and you did ask a question about a perfect
23 world about ten questions ago but you said in this
24 situation what wasn't done.

25 MR. LANCASTER: That was the question.



1 MR. HODGSON: I don't think that was the
2 question I asked.

3 MR. LANCASTER: The last one.

4 MR. HODGSON: Could we identify the
5 question?

6 Q. You said you disagreed and the
7 question was in a perfect world and then I asked ...

8 MR. McQUAID: What wasn't done.

9 MR. LANCASTER: What wasn't done.

10 MR. HODGSON: Q. You said it wasn't so
11 much what wasn't done but what was interpreted and I
12 asked you not to concentrate on what was interpreted
13 but on what wasn't done.

14 MR. PETRIE: A. The actual fractures
15 which carry fluid from one borehole to another have not
16 been delineated and the velocities in the fractures are
17 not provided and had they been provided they should
18 have been input in some fashion to an impact assessment
19 such that we would have an idea of the rate of
20 groundwater flow within those fractures that permit
21 groundwater flow. Mr. Sobanski delineated a ten-metre-
22 thick zone and used average values in some fashion to
23 delineate and within that zone he indicated to the
24 Board that he felt there was much more fractured rock
25 and much less fractured rock, but he did not provide in



1 his opinion an estimation of the rate of flow within
2 those fractures or exactly where those fractures were.

3 Now when questioned regarding the lack
4 of continuity of the chloride data within the zone and
5 tritium data within the zone, he indicated that was
6 just bearable fractures within the system but he has
7 not defined to my mind where the fractures are or where
8 they -- or the velocities within those zones and one
9 would therefore end up with an estimate of effective
10 transport porosity from this assessment and the
11 effective transport porosity incorporating an effective
12 hydraulic conductivity for a fracture zone which would
13 allow for an assessment of the rate of groundwater flow
14 within the fractures and not some bulk value that
15 incorporated flow within the fractured and non-
16 fractured portions of the rock.

17 Q. Didn't Mr. Sobanski identify a
18 zone of higher horizontal permeabilities that is
19 extensive at PW-1?

20 A. I believe he interpreted the
21 results of PW-1 to define the existence or confirm for
22 him the existence of his highly fractured zone.

23 Q. He identified what he thought was
24 a zone of high lateral permeability; right?

25 A. No. As I recall it he took a



1 vertical thickness of 0.3 metres or one foot and saying
2 of all the fractures that intersected that borehole if
3 I lumped them together one on top of the other it would
4 provide for me a sort of fracture aperture width of 0.3
5 metres and using that value he arrived at a hydraulic
6 conductivity of 10^{-2} centimetres per second was my
7 recollection, but he did not define those fractures in
8 space and his value of 0.3 metres was an assumption as
9 I recall his evidence.

10 Q. He assumed, did he not, that those
11 fractures were continuous under Highway 403
12 downgradient toward Aldershot?

13 A. He assumed they were continuous to
14 the extent of his definition of the highly fractured
15 zone and I note where he terminated his highly
16 fractured zone was where his modelling efforts
17 subsequently showed he had a discharge zone.

18 Q. Would it make any difference if
19 Mr. Sobanski was wrong in that there was another
20 underdrain under the one he identified that was also
21 continuous south of Highway 403? I want to know,
22 Mr. Petrie, what difference it makes whether or not
23 there is one highly fractured zone with lateral
24 continuity off-site or 17. What difference does it
25 make?



1 A. A mass of fluid transmitting those
2 zones might be 17 times as much in the latter case.

3 Q. Now, let's go back to page 113,
4 the middle of the page:

5 "Off site, weak downward gradients are
6 encountered immediately south of Highway
7 403. Further south in Aldershot, weak
8 upward gradients are encountered at
9 HC10, HC11 and HC12. At Lake Ontario,
10 the gradients are weakly downwards."

11 I would like to come back and discuss that paragraph
12 with you again tomorrow after we have had a chance to
13 look at the gradients southward, the density
14 corrections.

15 A. Excuse me, but we are going to
16 review the density corrections tomorrow?

17 Q. I'm going to ask you questions
18 about it.

19 A. Certainly.

20 DR. KINGHAM: On that point are you
21 going to confirm to your satisfaction that they have
22 been transposed to the exhibit?

23 MR. PETRIE: I will do that but I
24 understood he wasn't going to do that but I must have
25 misunderstood.



1 MR. HODGSON: Q. Continuing:
2 "Such evidence suggests that the
3 underdrain system which exists..."

4 And there is no equivocation there, do you agree:

5 "...the underdrain system which exists
6 beneath Site F extends off site to HC10,
7 HC11 and HC12."

8 MR. PETRIE: A. That is what I have
9 indicated, yes.

10 Q. "At HC11, Trow reported possible
11 fracture zones at 15.81-16.36 m; with
12 clay/mud seams at 16.4-20.0 m, 19.45-20-
13 68 m, ... as well as possible
14 slickenslides at 19.4-19.45 m, 19.86-
15 20.0 m and 21.43-21.52 m below ground
16 surface ... This fracturing may
17 comprise the lateral extension of an
18 underdrain."

19 Now, yesterday I was asking you to correlate the data
20 between boreholes located on Site F and you told me
21 that you had an enormous discomfort correlating between
22 the boreholes. Do you remember that?

23 A. I do.

24 Q. But you feel quite comfortable on
25 page 113 correlating data all the way from Site F down



1 to HC11 and that is a distance which is some
2 considerable distance south of the site; don't you
3 agree?

4 A. I'm not sure "correlating" is the
5 word I would use to describe this paragraph you have
6 referred to.

7 Q. I have asked the question and I'm
8 waiting for an answer.

9 A. You used the word "correlating"
10 and I cannot answer the question with the implication I
11 have correlated.

12 Q. Are you not suggesting in
13 paragraph 113 that there is a correlation between the
14 fractures you are describing in HC11 and the fracture
15 zone on Site F?

16 A. Not specifically. We have noted
17 on page 112, the previous page, that to account for the
18 gradient distribution at this site, the steeper
19 downward gradients on-site and generally lateral off-
20 site and with the weak component of upward flow under
21 Aldershot, we are simply noting that at HC11 there are
22 fracture zones encountered or described rather in the
23 borehole log and the last sentence says:

24 "This fracturing may comprise the
25 lateral extension of an underdrain."



1 So the key word is "may" and the reason that zone in
2 some fashion I believe ought to be there is to account
3 for the upward gradients. That is apparent to me if I
4 could take the modelling undertaken by Trow where they
5 terminated their drain just south of 403 and in the
6 general area just south of 403 and their modelling led
7 them to conclude there was a discharge gradient at that
8 point. We noted that by extending that drain to beyond
9 HC11, the position of that discharge zone would also be
10 modified.

11 This paragraph on page 113 says there
12 are fractures at HC11 and it may comprise the lateral
13 extent of the zone and were that zone to extend that
14 distance it could account for the upward gradients
15 encountered at that point.

16 Q. I suggest it's pretty important to
17 you to stretch that underdrain as far down to Aldershot
18 as you can.

19 A. With the intention of explaining
20 the gradients it is a hydraulic -- I wouldn't say
21 necessity, but it allows hydrogeologists to explain the
22 gradients, especially given that I do not see the
23 discharge zone as defined by Mr. Sobanski and also I
24 recall that Dr. Charlesworth undertook some additional
25 evaluations which entailed some fieldwork as well in



1 the discharge zone defined by Mr. Sobanski. He did not
2 see evidence of groundwater discharge at the bedrock at
3 this point. I do not see it using his data and
4 Mr. Sobanski's data. We note that in order to explain
5 the upward gradients encountered under Aldershot there
6 must be some pathway providing for more rapid lateral
7 flow from the site to at least that location.

8 Q. At HC11 what is the elevation of
9 15.81 metres on Exhibit H-645?

10 A. I don't know what you mean by
11 15.81 metres as the scale only goes down to 40 metres
12 in elevation.

13 Q. You say:

14 "...Trow reported possible fracture
15 zones (beginning at the top of the
16 borehole) at 15.81 ..."

17 ... metres and I'm asking where is 15.81 metres down
18 that borehole at HC11?

19 A. I believe I could refer to the
20 borehole log and I believe those words were taken in
21 general from the well records.

22 Q. I want a cross-reference to the
23 cross-section B-B.

24 A. Certainly and I would like to
25 check the well record if I might as well. The point of



1 15 metres appears to be directly at the base of the
2 overburden or the upper metre or so of rock, so for
3 HC11 we would be dealing with the upper two or three
4 metres of rock.

5 Q. The upper two or three metres of
6 the rock. Can we agree to assume that it is at
7 approximately elevation 77?

8 A. We can assume that, yes.

9 Q. HC8, the top of the bedrock at
10 HC8 is at what elevation?

11 A. One hundred and fourteen.

12 Q. The difference between 114 and 77
13 is ...

14 A. ... 23 and 14 which is 37 metres.

15 Q. So you would agree that leachate
16 that is going to travel through your underdrain and
17 reach that point at HC11 you are identifying at the
18 bottom of page 113 first must travel vertically 37
19 metres?

20 A. If it started at HC8, the bedrock
21 at HC8.

22 Q. And if it started at HC4 it had a
23 lot farther to travel?

24 A. That is correct.

25 Q. We don't have any evidence to



1 suggest that its vertical travel times are anything but
2 extremely long at this site, don't you agree?

3 A. I don't know what evidence we have
4 to indicate what the vertical travel times are.

5 Q. I'm sorry, but could I have that
6 evidence again? Are you saying as a qualified
7 hydrogeologist standing in this room surrounded by all
8 the data you see on the wall and which you have before
9 you in the book and everything here that you have no
10 evidence you have that would help the Board identify
11 the travel times vertically at Site F, none?

12 A. With reference to the chlorides at
13 HC4 for example I believe you used the word "anomalous"
14 for that data. We have chlorides of 47 milligrams per
15 litre at an elevation of 120 and you were implying that
16 that was recent flushing or recent flushing has reached
17 that 15 metres at some time, and you also indicated
18 immediately above that piezometer there was a portion
19 of the rock for which a packer test had given a zero
20 value and it was indicated at 10^{-8} . Therefore you
21 indicated as I recall in your hypothesis that water
22 could not have flowed directly down to that point and
23 we concluded it may have come from some point
24 upgradient and travelled some distance. Here we have
25 an example of fresh chlorides, if I can use that word



1 for a chloride level of less than 100, and at some
2 depth within the rock mass. I don't know how long it
3 would have taken for that to get there.

4 The other argument is the tritium data
5 which you and I are in disagreement on. The tritium
6 data we have is provided on H-662 where we have tritium
7 occurrences at the bottom of HC5, and I'm trying to
8 read the number, is it 4.6?

9 DR. KINGHAM: Four point six.

10 MR. PETRIE: In conjunction with high
11 chlorides which suggests in some fashion there is
12 mixing of water. Tritium would have migrated to
13 whatever depth it is encountered at since 1952, 30
14 metres, and I have no way of knowing if all of the
15 water would have migrated to the same depth at the same
16 time so we are looking at some sort of fracture
17 connection at that point. I don't know the nature of
18 that connection but I can only conclude it has taken
19 approximately 35 years to reach that point and that to
20 me is quite rapid vertical movement.

21 MR. HODGSON: Q. If it takes 35 years
22 for that water to reach that point, doesn't that
23 suggest that not very much water is moving vertically
24 in that rock and that the infiltration is low?

25 MR. PETRIE: A. I would not conclude



1 that. I would not relate tritium advance to
2 infiltration.

3 Q. Mr. Petrie, is it your evidence
4 that what we have below Site F is high vertical
5 permeabilities?

6 A. No, it's not.

7 Q. It's not. So, let's turn to page
8 114. We have your hydrostratigraphy at the bottom of
9 the page and sandwiched between your permeable drain
10 and your mantle of more fractured rock, items 1 and 3
11 we have:

12 "A thick lower permeable zone with
13 permeabilities generally ranging from 1
14 $\times 10^{-6}$ cm/sec to less than 1×10^{-8}
15 cm/sec."

16 Those are very low permeabilities?

17 A. Relative to values of 10^{-2} .

18 Q. And the travel times at 10^{-8} will
19 be very slow?

20 A. At 10^{-8} they would be slow and
21 ignoring -- one ought not to ignore the possibility of
22 some sort of fracture connection whereby there might be
23 much more rapid transport through that block of rock.
24 We are looking at travel times and there might be quite
25 rapid transport within the fractured mass.



1 Q. Concentrating if we could on page
2 114, items 1, 2 and 3 we have here:

3 "A heterogeneous upper weathered and
4 fractured bedrock zone which mantels the
5 entire site."

6 Then you agree with Mr. Sobanski that there is a zone
7 of upper weathered and fractured bedrock?

8 A. I believe Mr. Sobanski did not
9 mantle the entire site with his. If you are
10 restricting it to the upper portions of the rock that
11 it is heterogeneous, weathered and fractured I believe
12 we have used similar words, but I'm not sure we are
13 describing the same geometry.

14 Q. You agree with Mr. Sobanski that
15 Site F is underdrained?

16 A. I do.

17 Q. You agree with Mr. Sobanski that
18 between this weathered and fractured zone and this
19 underdrain there is a lower permeability zone?

20 A. To provide the contrast, yes.

21 Q. The only difference between you
22 and Mr. Sobanski is that you and Mr. Sobanski can't
23 agree on how thick that middle zone -- not the only
24 difference, but one difference between you and
25 Mr. Sobanski is that you don't agree on how thick that



1 middle zone, that less permeable zone is?

2 A. That is one of many differences.

3 Q. The difference is that

4 Mr. Sobanski by studying the data thinks he knows how
5 thick that zone is and you by studying the data haven't
6 the faintest idea?

7 A. I have reviewed the data provided
8 by Mr. Sobanski and I have critiqued the document in
9 which he made his conclusions and I do not believe he
10 can support his conclusions. I beg your pardon, I am
11 of a different opinion that his conclusions are not
12 supported.

13 Q. You have drawn no conclusions of
14 your own to help this Board about the thickness of this
15 unit?

16 A. I have said I can't define it
17 based on the data I have available to me.

18 Q. What data would you need before
19 you could define it?

20 A. It would require an elaborate
21 testing procedure, a number of boreholes, packer tests,
22 better vertical definition of the hydraulic
23 conductivity in each borehole and recognizing ...

24 Q. Basically your bottom line?

25 MR. McQUAID: He hasn't finished.



1 MR. PETRIE: I was going to say
2 recognizing there is a considerable degree of
3 variability across the site.

4 MR. HODGSON: Q. Your bottom line is
5 you need more information?

6 MR. PETRIE: A. I can't agree with the
7 conceptualization of the site as defined by
8 Mr. Sobanski.

9 Q. I'm not asking you to agree with
10 the conceptualization in this question, but I'm asking
11 you to define the thickness of that unit.

12 A. I would need more information to
13 define the thickness of that unit.

14 Q. Yes. You would need more
15 information to determine where that underdrain is as
16 well, wouldn't you?

17 A. I would.

18 Q. You would need more information to
19 determine the thickness of the upper weathered and
20 fractured bedrock, wouldn't you?

21 A. Yes.

22 Q. The bottom line then for
23 Mr. Petrie is that with all the studies that have been
24 done at the Bayview Landfill Site by a number of
25 investigators including your own firm and all the



1 studies done at the Burlington Landfill Site by Gartner
2 Lee and all the studies done on Site F by Morrison
3 Beatty, the University of Waterloo and Mr. Sobanski's
4 firm, Trow/Hydrology Consultants, we don't have enough
5 information to interpret the hydrostratigraphic regime
6 at Site F?

7 A. We have a variety of
8 interpretations provided and that variety also
9 indicates to me that there is some disagreement between
10 the various investigators. For example, as Mr.
11 Crutcher pointed out this morning, there has been a
12 shallow and deep system defined and the dividing line
13 between the shallow and deep zones varies between
14 investigators and none of those shallow and deep zones
15 are defined with respect to any one borehole. One
16 cannot go along and take the information and say here
17 is a shallow zone and here is a deep zone. That is
18 being done in a general sense and indeed what Dr.
19 Charlesworth did, having recognized the stratigraphic
20 definition was tenuous, which were his words, he took a
21 value of I recall 25 metres and said this is probably
22 the active zone. I am not the first -- I am suggesting
23 Dr. Charlesworth was before me, but a number of us feel
24 that the site cannot be defined categorically.

25 Q. When it comes to divergence of



1 interpretation would you agree there is a divergence of
2 interpretation about Site D as well?

3 A. Yes.

4 Q. The fact one hydrogeologist comes
5 along and says we don't have enough information to
6 understand something is not to lead anyone to the
7 conclusion that someone else can't understand it, does
8 it?

9 A. I think that that's a fair
10 statement. People can have differing opinions.

11 Q. Do you recall Dr. Charlesworth
12 told us he couldn't understand Site D because he didn't
13 have enough information?

14 A. I recall that.

15 Q. But you have no problem
16 understanding Site D?

17 A. In the domain in which
18 hydrogeologists typically, and I for one am a bit more
19 comfortable in dealing with a porous media, but
20 fractured rock provides for a significant degree of
21 hydraulic uncertainty in my mind. If I could make an
22 additional statement, on page 115 I note at the top
23 this conceptualization and I call it a simplified
24 hydrogeological interpretation, does not reflect the
25 complexity of the site as evidenced by the various



1 points and recognizing I also have difficulty
2 understanding the site in the details which I like, so
3 I have had to step back and draw some very gross
4 simplifications in order to provide some sort of
5 conceptualization to the Board.

6 Q. I would have to tell you that when
7 I read that sentence I wrote down in the book "None of
8 the data fits but this is my interpretation" and is
9 that a fair statement? Is that a fair paraphrase of
10 the statement at the top of page 115?

11 A. Some of the data has to fit.

12 Q. Some of the data has to fit in
13 order for you to give us this interpretation?

14 A. My interpretation is based on a
15 very simplified picture of the data and I have
16 recognized the complexity of the data but I cannot
17 evaluate it at the level consistent with that
18 complexity.

19 Q. Some of the data fits so you are
20 able to provide the Board with a hypothesis as to a
21 generalized hydrostratigraphy for Site F. It has an
22 upper weathered and fractured bedrock, a thick lower
23 permeable zone and it has an underdrain?

24 A. That is a very general picture,
25 yes.



1 Q. One distinction between you and
2 Mr. Sobanski is that Mr. Sobanski can take the same
3 information and provide this Board with a very good
4 idea as to the thickness of the upper weathered and
5 fractured bedrock, the permeable zone and the
6 underdrain but you can't do that?

7 A. I reviewed -- as I understand it,
8 it was the same data although I point out you have
9 provided me with more data today which was not
10 available earlier, but taking the data available to me
11 I couldn't come to the same conclusions as Mr.
12 Sobanski.

13 Q. Mr. Petrie, one other question.
14 Mr. Sobanski reviewed the data at Site D and determined
15 an explanation for the hydrostratigraphic regime which
16 he presented in his report. Mr. Sobanski reviewed the
17 data at Site F and determined the hydrostratigraphic
18 interpretation which he presented in his report.
19 Dr. Charlesworth reviewed Mr. Sobanski's data for Site
20 D and his interpretation for Site D and concluded there
21 wasn't enough information to understand Site D. John
22 Petrie reviewed the information at Site F and the
23 interpretation at Site F and concluded there wasn't
24 enough information to understand Site F.
25 Dr. Charlesworth reviewed the information at Site F and



1 concluded that he could understand Site F and John
2 Petrie reviewed the information at Site D and concluded
3 that he could understand Site D. Dr. Charlesworth's
4 client is the Town of Milton and John Petrie's client
5 is the City of Burlington. Is it your evidence that
6 this is pure coincidence?

7 A. No, not at all.

8 Q. How do you explain this strange
9 phenomenon that you can't understand Site F and
10 Dr. Charlesworth can't understand Site D?

11 A. With respect to Dr. Charlesworth's
12 characterization of Site F, I note that his first
13 conclusion as I recall it from his document, the
14 exhibit number of which escapes me, is that the
15 hydrostratigraphic interpretation provided by Trow was
16 tenuous. I take that to mean that he couldn't agree
17 with the hydrostratigraphic layers provided by Trow and
18 in my opinion therefore he could not agree with the
19 travel times of the groundwater flow system, the
20 proposed monitoring locations, the contingency options
21 and a number of other things which accrue from having a
22 hydrostratigraphic definition of the site. However, he
23 stepped quite a ways back and said "Let's look at it in
24 a very general sense" and he concluded as I recall that
25 you had a zone of generally lateral flow of about 25



1 metres thick and I gather that that was a very general
2 interpretation in his mind. I think you pointed out to
3 him in cross-examination that there were some steep
4 gradients in the system that may be explained by an
5 underdrain of some sort and I have a vague recollection
6 that he concurred in some fashion and felt his
7 simplified hydrogeology may be perhaps a bit too
8 simple. He could not provide the definitive
9 hydrogeologic characterization of Site F and so I'm not
10 so sure Dr. Charlesworth and I are at great variance.

11 At Site D where Dr. Charlesworth and I
12 are at variance, is his interpretation with respect to
13 a lack of information and to me the critical
14 information required at Site D is the upper unweathered
15 clay is the primary layer upon which landfilling is to
16 take place and to establish its continuity and
17 hydraulic properties is of importance in undertaking an
18 assessment for landfilling suitability at this site. I
19 am trying to recall Dr. Charlesworth's evidence on
20 that, but let me go on to the second point and that is
21 the characterization or continuity of the contaminant
22 flowpaths at Site D. Based on my interpretation of the
23 pumping test data which indicated to me that for the
24 upper granular unit indeed a lack of recovery suggests
25 there may be a lens, I concluded that that pathway was



1 not of particular significance but I did point out it
2 was prudent to consider that it did extend off-site for
3 the purposes of undertaking an impact assessment. As I
4 recall when questions to Dr. Charlesworth were put
5 regarding the lack of recovery in that unit, the upper
6 granular unit, he considered, and I'm going by
7 recollection and I don't have the transcripts before me
8 and indeed I haven't read it, but I recollect Dr.
9 Charlesworth said "perhaps" or "may" or used some
10 qualifier that it could be a lens, in which case it
11 would not in his mind provide for lateral off-site flow
12 and that the flow directions within that lens would
13 therefore be in some fashion controlled by the
14 enveloping till and in the vertical plane flow would
15 probably be downwards across that.

16 To sum that up with respect to some key
17 components in Dr. Charlesworth's and my interpretation
18 of Site F, we are not so dissimilar. With respect to
19 Site D I believe he considered the upper granular unit
20 may be a lens and I am at a loss to recall his
21 conclusions with respect to the upper unweathered till
22 and so I cannot recall to you now to the extent which
23 Dr. Charlesworth and I differ on the hydrogeologic
24 interpretations on Site D.

25 I might also point out that Site D is a



1 porous media site composed of sands, gravels and clays
2 and as much as hydrologic science has been developed in
3 the domain of porous media, the geology of the site or
4 the hydrostratigraphic interpretation of that site can
5 be more easily undertaken from a visual inspection of
6 the samples. In my opinion it is a more easily
7 evaluated site were one to have exactly the same data
8 base at two sites, which sounds like a perfect world,
9 one might be in a position to make definitive
10 conclusions regarding the site, generally a layered
11 site, if that is the word, in a porous media than a
12 fractured rock site.

13 Q. Site D is easier to understand
14 than Site F?

15 A. That is my opinion.

16 Q. Site F is a non-thorny, difficult
17 intellectual problem to solve?

18 A. It's a hydrogeologic problem.

19 Q. It's a difficult problem to solve?

20 A. Given the various opinions
21 provided and the lack of continuity among some of them,
22 it is obviously difficult.

23 Q. When you have a very difficult
24 problem to solve, that takes a lot of imagination and
25 energy to solve it, don't you agree?



1 A. Yes, and recognizing having
2 expended a lot of imagination and energy and presumably
3 time and dollars, one may not have arrived at a
4 conclusive or comfortable interpretation and one
5 consistent with the bulk of the data or consistent with
6 the bulk of the other investigators.

7 Q. I suggest, Mr. Petrie, that if you
8 don't want to understand something that is easier to
9 accomplish than to set out to understand it.

10 A. That's a general question and I
11 have trouble...

12 Q. A very general question.

13 A. Perhaps.

14 Q. The answer for Site F isn't going
15 to come to you without a lot of difficult study, is it?

16 A. And it may not come, or depending
17 upon the scale on which one needs the answer.

18 Q. It may not come to John Petrie?

19 A. It may not or it may in time with
20 additional data.

21 Q. Will you agree with me,
22 Mr. Petrie, that there is a logical distinction between
23 the following two statements? Statement one: "I, John
24 Petrie, do not understand Site F" and, statement two;
25 "Site F cannot be understood"?



1 A. There is a difference.

2 MR. HODGSON: Thank you. Tomorrow?

3 MR. LANCASTER: Are you concluded with
4 your cross-examination?

5 MR. HODGSON: No.

6 MR. LANCASTER: It's just the way you
7 said that.

8 MR. HODGSON: That sounded so much like
9 an invitation I apologize for answering almost rudely.
10 I have not completed and I'm not very far from the end
11 but I need to deal with these gradients south of 403
12 and I need to deal with the pumping data which I
13 couldn't deal with today and I wanted to deal with
14 today and a couple of other topics to deal with. I
15 should finish some time tomorrow.

16 MR. LANCASTER: All right. We will
17 adjourn until 9:30.

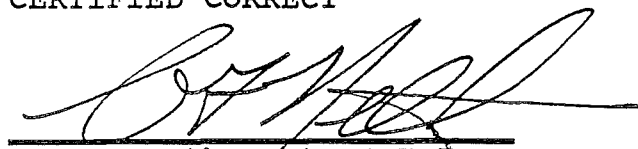
18 --- Adjournment (4:30 p.m.)

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20 CERTIFIED CORRECT

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C. F. Nethercut, C.V.R.

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(page 28650 follows)

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