

HALTON REGION LANDFILL TECHNICAL STUDY
NOISE ANALYSIS
SITE D
SCHEDULE J-D

Prepared for
THE REGION OF HALTON

Prepared by,



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HALTON REGION LANDFILL TECHNICAL STUDY

NOISE ANALYSIS

SITE D

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NOISE ANALYSIS
SITE D

EXECUTIVE SUMMARY

A review of the noise aspects of Site D has re-identified one area in the south west corner of the site where the sound levels would be excessive unless mitigation is provided. These areas were first identified during the Stage 2C Noise Report as requiring mitigative measures. Measures were suggested in the Stage 2C Report to minimize the noise in these locations.

The extra traffic on Highway #25 as a result of landfill operation at Site D, will not significantly add to the sound already present from current traffic volumes, and will become even less of a factor as the non-landfill traffic volume on the highway increase in the future as noted in the Transportation Analysis Report for the Site.

why is
the
non-
landfill
volume
on the
highway to
increase
in future?

MITIGATION

Development of a detailed site design for Site D has identified the availability of large amounts of excess cover material. This material can be utilized as a large berm along the southern portion of the western property line of the site to provide a noise barrier between the land filling and the residents. The eight to nine metre high berm recommended will allow the site to operate within the Ministry of the Environment's noise guidelines for landfill sites.

In the Stage 2C report it was noted that some homes to the southeast of the site would require mitigation measures. The detailed site plan developed by the design and operation consultant shows that the site area to be filled has been reduced from that identified in the Stage 2C report, allowing operations to move back from the eastern edge of the site. With the presence of high background noise from Highway #25 traffic, the sound levels at the residences east of the landfill will not be significantly affected by landfill operation.

CONCLUSION

The site appears to have no noise problems which would preclude its meeting the MOE noise criteria during landfilling operations. During the construction and eventual removal of the western berms, there will be a 2 month construction period when the MOE criteria are exceeded.

NB

isn't that true for Fas well as Figure 4 in Site F study. why no mention this in F report.

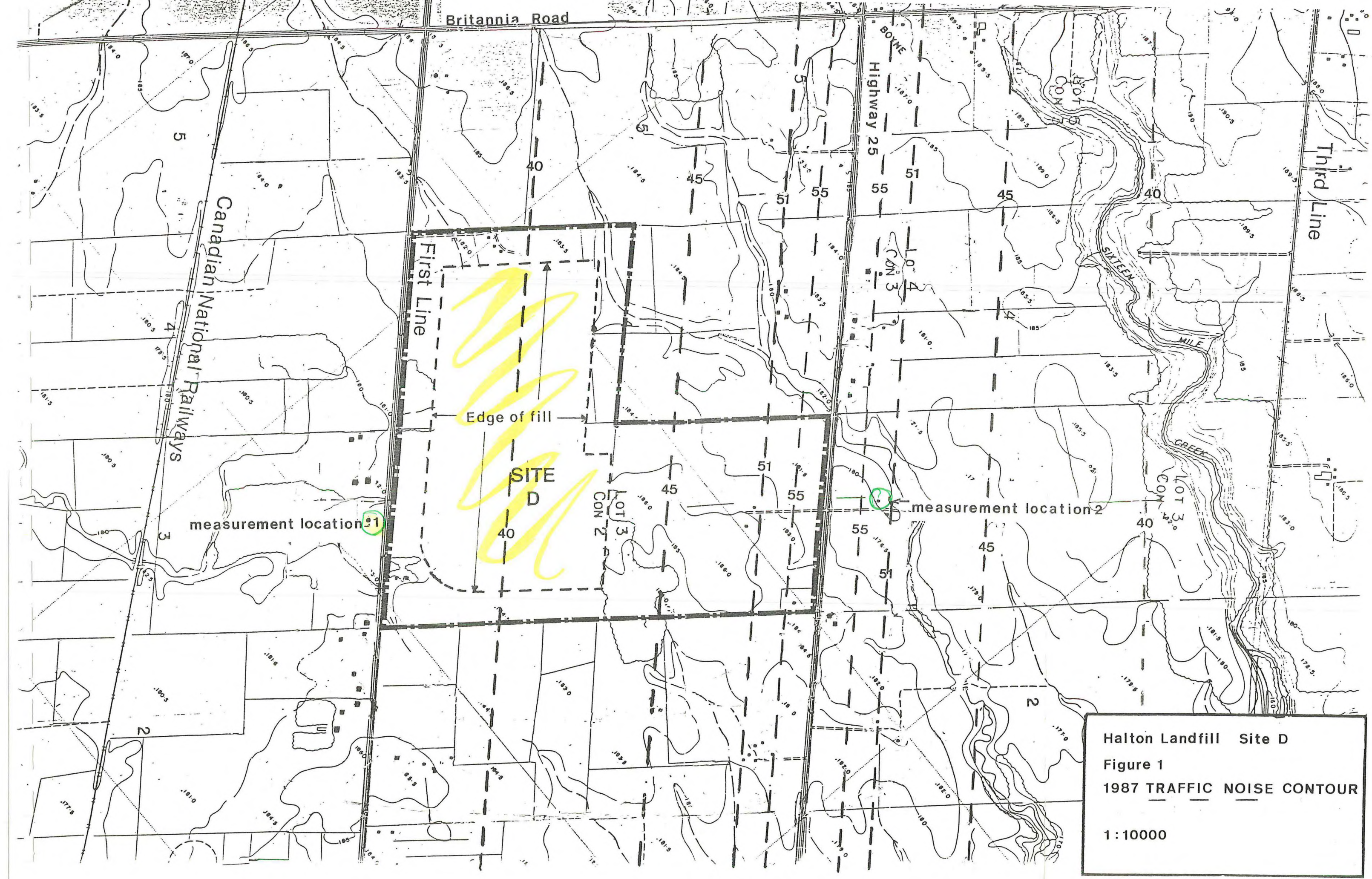
HALTON REGION LANDFILL TECHNICAL STUDY NOISE ANALYSIS SITE D

1.0 INTRODUCTION

At the request of the Region of Halton, Barman Coulter Swallow Associates has carried out a noise analysis of the proposed Landfill at Site D (Fig. 1), located south of Britannia Road, between Highway #25 and First Line, south of Milton. The site was reviewed as part of the Stage 2C Environmental Assessment for the selection of Halton's new landfill site.

The purpose of this report is to:

1. Determine the anticipated noise levels in the surrounding affected community (within 500metres in this case),
2. To determine the areas where sound levels above the Ministry of the Environment guidelines might occur,
3. To recommend measures by which the site can be utilized without exceeding those guidelines.



Halton Landfill Site D
Figure 1
1987 TRAFFIC NOISE CONTOUR
1:10000

2.0 REVIEW OF ENVIRONMENTAL ASSESSMENT STUDY STAGE 2C

In Environmental Assessment Stage 2C Study it was anticipated that this site would meet the requirements of the Ministry of the Environment in most of the surrounding residential sites for most of the time. However, it was expected at that time that there would be a 1 to 2 year time period at the outset of the landfilling during which there would be a significant excess along the First Line in the southwest corner of the site. To minimize the impact, it was proposed in the Stage 2C Noise Report that filling along the western edge of the site proceed as rapidly as possible. This 15 metre high berm of landfill material along the edge of the site would thereafter act as a noise barrier while landfilling proceeded on the balance of the site. With the more detailed site design data now available (refer to the Design and Operations Report for Site D), it is possible to recommend more effective means of mitigating noise along the western side of the site.

Also mentioned in the Stage 2C study was the need for mitigation in the southeast corner of the site in the same form as noted above. The most current site layout no longer employed for landfilling purposes, those areas which were close to the residents to the east of the site across Highway #25, or

in the southeast corner. This change is reflected in the absence of mitigation requirements for this area in the recommendations of this report.

3.0 METHODOLOGY AND CRITERIA

The Ministry of the Environment requires that landfill sites should not produce ¹Leq (average sound levels) above the background traffic noise ²Leq or 55 dB (decibels), whichever is higher. The evaluation involves determination of the background sound levels and the sound levels that will be produced by the landfilling activity using a combination of prediction models and field measurements.

For traffic noise, impact on the continuity is evaluated by noting the sound level of the roadways without the landfill traffic either by standard prediction methods or measurement, and then computing the increase in sound levels anticipated due to the traffic generated by the landfill activity. The noise impact is considered to be significant if the additional traffic causes an increase of 3dB or more, the step change required to be noticeable to the average observer.

4.0 EVALUATION OF BACKGROUND NOISE ENVIRONMENT IN RESIDENTIAL USE AREAS

At present, the major feature generating noise in the area is Highway #25. Traffic volume is moderate at about 8000 vehicles AADT (Average Annual Daily Traffic) for the past several years. With a posted speed of 80 kilometres/hr, it generates sound that dominates for distances up to 1 kilometre. Using the Ministry of Transportation and Communications "Simplified FWA Noise Prediction Method" (MT&C REPORT AE-82-50) for highway noise prediction, the sound levels during daytimes are calculated in Worksheet #1 and are shown in Figure #1.

To substantiate the noise predictions, noise monitoring was carried out at two points shown on Figure #1: one along the highway, and one on the First line. Several days' results from each site are given in Tables 1 and 2. The data is taken on an hour by hour basis (the first column of the tables). The L_{eq} for each hour is given as the second column. This index of noise measurement, found to be the most useful one by various planning agencies such as the Ministry of the Environment, represents the average sound energy over the measurement period. In the case of Tables 1, and 2, the averaging period

Table 1

JOB NAME
LOCATION
DATE
STARTING HOUR=
LAST FULL HOUR
OFFSET=43

HALTON LANDFILL EPA
5824 FIRSTLINE MILTON
85.9.26

15
4DAYS

14

HR.

loudest

HOUR	LEG	L90	L50	L10	L1	L0.1
DAY#						
3 pm - 4 pm 15	61	53	59	64	67	70
16	57	48	55	59	66	70
17	56	47	52	59	66	71
18	52	43	44	54	64	70
19	52	43	44	55	63	69
20	52	43	48	56	60	65
21	49	43	46	52	59	65
22	48	43	44	49	59	67
23	48	43	43	46	60	65
DAY#						
0	46	43	43	44	54	62
1	48	43	43	47	55	69
2	45	43	43	43	52	65
3	43	43	43	43	45	49
4	45	43	43	43	53	63
5	44	43	43	43	52	59
6	51	43	43	48	64	70
7	55	43	46	58	66	71
8	55	44	46	57	67	73
9	52	45	48	53	64	70
10	55	46	49	57	65	73
11	55	46	50	58	65	72
12	58	47	52	59	67	76
13	56	47	52	59	66	71
14	57	47	53	60	67	72
15	57	48	53	60	67	72
16	57	47	52	61	67	72
17	55	45	50	58	66	71
18	54	43	48	57	65	69
19	53	43	43	54	65	72
20	50	43	43	52	62	67
21	47	43	43	44	59	65
22	49	43	43	50	60	67
23	49	43	43	48	62	68

Site D

Table 1'(cont)

HOUR	LEQ	L90	L50	L10	L1	L0.1
	DAY#	2				
0	50	43	43	44	60	71
1	47	43	43	47	58	66
2	45	43	43	43	53	62
3	45	43	43	43	45	65
4	46	43	43	44	58	61
5	47	43	43	47	58	60
6	52	43	43	45	61	76
7	59	43	43	52	74	79
8	53	43	43	55	64	74
9	52	43	43	53	64	70
10	52	43	43	52	64	69
11	52	43	44	53	63	72
12	57	43	44	52	63	75
13	52	43	44	53	64	71
14	52	43	45	52	64	71
15	57	43	46	56	70	79
16	59	43	44	59	72	76
17	52	43	43	53	64	69
18	52	43	43	54	64	69
19	52	43	43	52	63	69
20	49	43	43	51	61	67
21	55	43	43	50	64	78
22	49	43	43	52	61	65
23	46	43	43	46	57	63
	DAY#	3				
0	47	43	43	49	58	64
1	49	43	43	46	61	66
2	47	43	43	43	59	62
3	45	43	43	43	53	64
4	44	43	43	43	43	60
5	43	43	43	43	44	45
6	45	43	43	43	51	63
7	50	43	43	46	63	68
8	52	43	43	52	62	74
9	50	43	43	53	62	68
10	49	43	44	50	61	66
11	51	43	45	53	64	69
12	51	43	45	51	62	68
13	50	43	43	51	62	69
14	51	43	44	51	62	69
15	52	43	45	55	64	70
16	54	43	46	56	66	72
17	50	43	43	51	61	68
18	49	43	43	52	61	65
19	52	43	43	54	64	69
20	50	43	44	53	61	66
21	49	43	43	48	61	63
22	50	43	43	49	61	70
23	49	43	43	49	61	68

Site D

Table 2

JOB NAME
LOCATION
DATE
STARTING HOUR=
LAST FULL HOUR
OFFSET=43

HALTON LANDFILL EPA
5409 HWY 25 MILTON
85, 9, 30

Hy 25.

		18	2DAYS		12	HF.	
HOUR	LEQ	L90	L50	L10	L1	LO.1	
DAY#		0					
18	54	45	51	57	63	70	
19	53	43	50	57	63	65	
20	52	43	48	55	61	64	
21	49	43	46	51	59	63	
22	50	43	48	53	59	64	
23	50	43	47	52	60	63	
DAY#		1					
0	49	44	47	51	59	61	
1	48	43	47	50	56	61	
2	49	44	47	50	59	63	
3	47	43	43	48	58	62	
4	52	44	46	51	62	73	
5	55	44	46	54	69	73	
6	53	45	49	56	63	67	
7	56	46	53	60	66	70	
8	56	47	54	59	64	69	
9	55	44	51	59	65	68	
10	56	43	51	60	66	69	
11	56	44	51	60	66	69	
12	57	44	51	59	67	74	
13	56	43	51	60	65	68	
14	56	45	52	60	65	68	
15	57	45	52	59	67	74	
16	55	46	53	59	64	68	
17	55	46	52	59	64	69	
18	54	45	52	58	62	66	
19	53	43	50	57	63	66	
20	52	43	49	55	62	65	
21	51	43	47	54	60	64	
22	51	43	47	54	61	65	
23	50	43	46	54	60	64	
DAY#		2					
0	50	43	43	52	63	69	
1	48	43	43	49	59	64	
2	49	43	43	51	60	68	
3	46	43	43	45	57	61	
4	49	43	43	50	61	65	
5	55	43	43	57	67	74	
6	54	43	49	57	65	69	
7	56	48	54	60	64	67	
8	56	48	54	60	64	68	
9	56	43	52	59	65	69	
10	57	45	53	61	67	70	
11	56	44	51	60	65	70	
12	54	43	49	58	65	68	

is one hour. The other noise indices, L_{90} , through $L_{0.1}$, are not used in this report. They are explained in Appendix II should the reader be interested.

To be sure that the noise was generated by traffic rather than high winds or precipitation, confirmation was made with the Pearson International Airport weather office that the meteorological conditions on these dates did not affect the measured sound levels. Background sound levels from present traffic along Highway #25 are higher than predicted for the daytime period at the 100 metre setback used in monitoring Highway #25. The typical daytime sound level of 50 dB L_{eq} along the First Line is typical for rural locations with the amount of traffic in the area around this site.

NB

did he say this in F. report?

5.0 EVALUATION OF LANDFILL SOUND GENERATION

5.1 Individual Source Sound Levels

The sources of sound on the landfill site include (in order of sound contribution):

1. Packers: steel wheeled tractors with plows that push the fill into position and, by running over the fill, pack it down.
2. Scrapers: Large articulated vehicles with a hopper that can be loaded and emptied as the vehicle passes over an area and used to move covering soil onto the fill areas.
3. Bulldozers: used for grading and excavation
4. Trucks: bringing waste to the site.

Landfill noise is dominated by the packers that operate relatively steadily, moving up and down the open face, spreading and packing down the material. The packers are powered by the same type of engines as bulldozers and other

off-road equipment. Their priority on the list of noise sources stems mainly from their nearly constant operation on the working face.

The scrapers are not operated as often as the packers, though when active, they may be the dominant noise source for short periods because of their height and the relatively constant high engine speed. They may be particularly evident when operating near the property line dumping or picking up cover material.

Bulldozers are used to grade the site and assist in covering, and for excavation. Like the scrapers, they are most noticed when working on excavation or grading near a property line.

Trucks bringing waste, in the case of Site D, are not significant contributors to the landfill noise field until they are 800 metres or so west of Highway #25. Once on top of the fill, they would produce sound levels that are slightly below the other individual sources, and usually for only a relatively short period of time. Once at the face, idling, they produce low engine sound levels (about 75dB at 15 metres) until they dump. Among the other sound sources on site, most of which are associated with the operation of large diesel engines, the

same
as at
F

trucks' backup signals and tailgate banging are notable because of their different characteristics: the backup warning signal because of its tonality, and the tailgate bang because of its impulsive nature. While they are identifiable to listeners, these sounds do not add significantly to the overall sound energy as measured in L_{eq} .

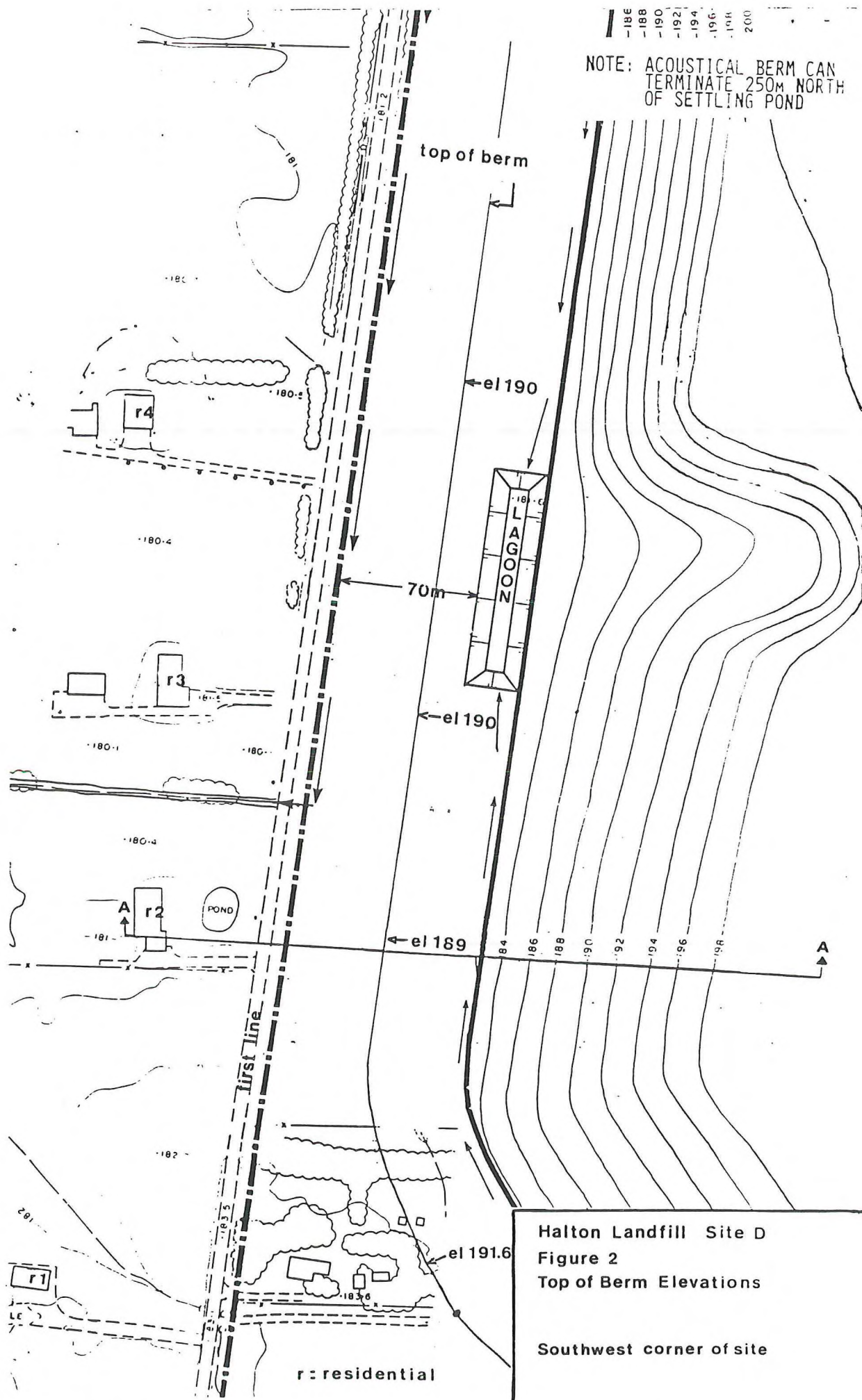
To confirm the sound levels used in the model of the noise source, the various pieces of equipment currently in use at the Regional landfill site in Burlington were tested individually. The sound levels found are consistent with the current MOE recommended sound levels for these vehicles of 85dB maximum measured at 15m as per the Ministry of the Environment's Model Municipal Noise Control Bylaw NPC - 115 Construction Equipment. Under load, all equipment was measured to be in the range of 82 to 85 dB.

Worksheet #1 shows the assumptions made for each of the major sources as they affect the sound emanating from the face. To assemble an acoustical model, one must include the source strength (in this case the sound level at 15 metres from the source), the source height, the duty cycle (percentage of time it generates high sound levels), the number of vehicles active at any one time, and the length of time it is in the fill area.

5.2 Landfill Sound Propagation - Source to Receiver

From the above observations, an average rate of sound emission can be calculated as per the Worksheet #1 (82 dB L_{eq} at 30m total source strength): this is the figure that forms the starting point for the sound propagation calculation. To establish the sound levels at a given location, one must account for source strength, distance, any obstructions in the path (barriers), ground effect (an attenuation factor dependent on the "softness" of the ground and the height of the source and receiver), and in the case where ground and/or barrier effects are significant, the modulation of these effects by wind and temperature gradients.

These factors are combined in the calculations shown in Worksheet #2. This prediction has been carried out for the "worst case" period at those residences which would be most affected by landfill at this site. The houses for which detailed calculation has been carried out are located in the southwest corner of the site and are shown in Figure 2. The sound levels predicted apply from 0800 to 1800 hours, Monday to Friday. Because of much reduced activity, Saturday morning sound levels will typically be 5 dB lower than those created during the week days. The sound level reach its maximum for a



Halton Landfill Site D

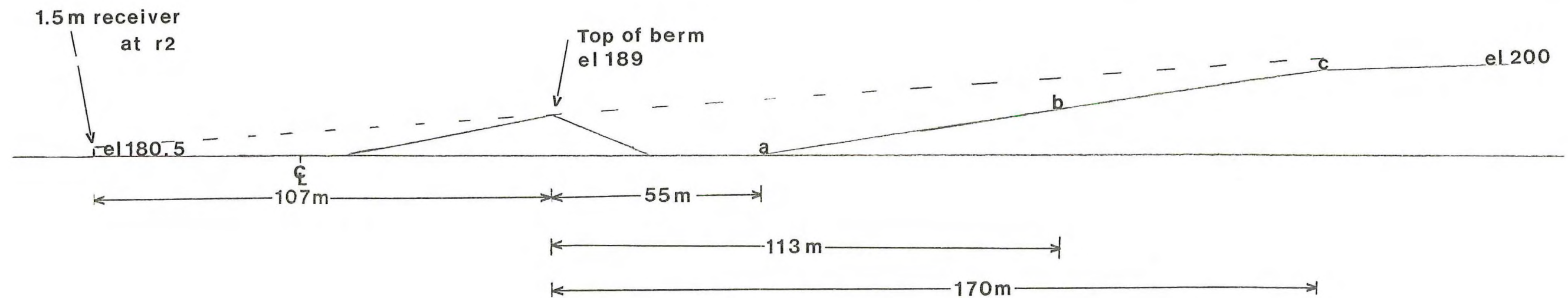
Figure 2

Top of Berm Elevations

Southwest corner of site

period of 12 to 18 months for any one residential location along the western property line. The balance of the time the sound levels will be lower. As can be seen in Figure #4, the sound just reaches the Ministry of the Environment criterion of 55 dB on the worst case situation corresponding to landfilling high up near the edge of the landfill area.

The major mitigation feature shown in the calculations is the large berm along the western property line. This berm is high enough to break the line of sight between a ground observer at grade near the residences west of the site and the equipment noise source for all but the highest elevation on the site. At the highest elevations, the sources are set back from the homes considerably further than the edge of landfilling. The extra distance from the residences compensates for the absence of barrier (see Figure 3). The required berm elevations and fill area contours are shown on the Figure 2 which is a map of the southwestern portion of the site's proposed final contours prepared by the design and operation consultant. The berms acoustical purposes are served provided it continues as far as 250 meters north of the proposed settling pond as located in Figure #2 and to 200 metres east of the western property line along the southern edge of the landfill area.



sound source locations

a - bottom of fill
 b - midpoint along fill
 c - top of fill
 source height - 2m

1:1000

Halton Landfill Site D
 Figure 3
 Cross Section(A-A) Showing
 Berm, Receiver, And Sources
 1:1000
 (see Figure 2)

All other residences including those to the east of the site are 500 metres or more from the active face of landfilling. At this distance they will always be 55dB L_{eq} (the criterion level) or less as a result of landfilling on the site (see Worksheet #1).

While the sound of landfilling is the major concern over the long term, the western boundary berm construction, and its eventual reclamation as cover material will, for a relatively short period, produce comparatively high sound levels. Worksheet #3 relates to the activity of assembling the berm. The total berm volume has been estimated by the design and operation consultant to be 340,000 cubic meters of material and is proposed to be supplied from excavation of the first cell of land filling operations. From Worksheet #3, it can be seen that ~~the sound levels within 30 meters of the homes located along this berm will be in the 60-65 dB range for a period of approximately 6-8 weeks.~~ Appendix 1 outlines a procedure by which the noise of berm construction can be minimized to achieve the sound levels of 60 to 65 dB L_{eq} demonstrated above.

Although the berm could be brought to full height more quickly by increasing the slope toward the houses from approximately 6:1, up to 3:1, advice on the visual aspects indicated that the 3:1 slope would not be appropriate visually. The 6:1 slope was considered the better alternative overall.

Relative to the original mitigation technique postulated for this and other sites during the Stage 2C Environmental Assessment (the berm constructed as part of the landfilling activity) the berm recommended in this report represents a considerable improvement. It ensures that, except for the early construction phase and during the final rehabilitation of the site, the sound levels in this area will fall within the Ministry of The Environment guidelines for landfill sites.

*is this
not
also
true
for
Site
F?*

5.3 Long Term Sound Levels

While the "worst case" scenario for noise exposure is the basis on which the Ministry's criterion is used, it does not represent, the typical exposure which landfill neighbours experience. As a guide to the pattern of noise exposure over the landfill's 20 year lifetime, a time history has been assembled as shown in Figure #4 for houses r1 to r4 of Figure

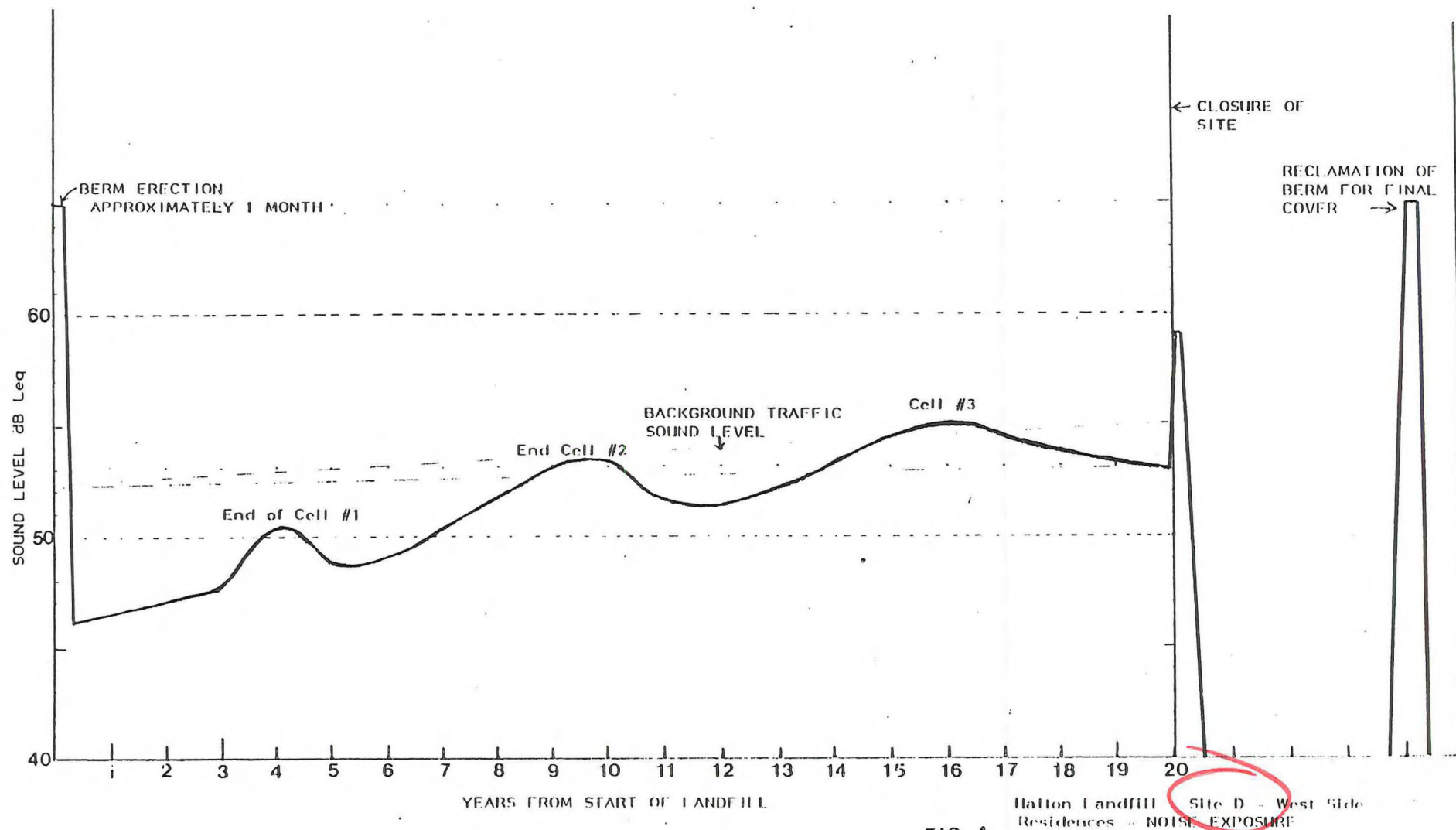


FIG. 4

#2 to the west of the site. In Figure #4, the effect of the early construction and filling can be followed as it moves down from the north of the site, passing to the south. Simultaneously, the background noise in the area will gradually increase as the traffic on the roads increases. The sound levels estimated for the final rehabilitation and their timing are speculative. Technological improvements in equipment may reduce the sound generated by off-road equipment by that time. The final cover could be put on sooner than five years after site closure. We have assumed the use of current technology in this study.

The western property line is the most critical one. Houses to the east of the fill area have also been reviewed. All of these dwellings however, are at least 500 meters from the working face and will fall below 55dB (see Worksheet #1). In addition, these homes are already about 55 dB L_{eq} due to traffic noise from Highway #25. In this case, both forms of MOE's criterion apply; the 55 dB minimum limit and the background traffic noise limit. No special mitigation is recommended for these houses.

5.4 Landfill Roadway Traffic Noise Evaluation

The access to the site from Highway #25 rather than from any lightly travelled route, avoids any significant increase in sound levels due to traffic using the site. To the north, the additional 80 heavy vehicle passbys each day will increase the roadway sound levels by 0.5 dB. To the south, the additional 340 or so heavy vehicle passbys will generate an increase of 1.5 dB along the route.

In the immediate area of the turnoff, the new traffic will have a slightly larger effect. In the first 200m or so, the slow moving, accelerating and decelerating trucks will be 1 to 2 dB noisier than similar vehicles passing as through traffic. Note that the effect is smaller than might be expected to be the case since incoming trucks are decelerating, and thus a little quieter than normal through traffic. The net effect is that for about 200m to the north the sound levels of road noise are raised by 1 dB and for the same distance to the south the sound would rise by 2 dB.

6.0 COMPARISON OF NOISE IMPACT TO CRITERIA

6.1 Comparison at Landfill Noise to MOE Criterion

The Ministry of the Environment criterion of 55dB L_{eq} has been accommodated at all residential locations except for the berm erection and removal along the south western boundary of the site.

6.2 Comparison to Traffic Noise Criteria

In terms of noise impact, the sound level increases are regarded as small.

The generally accepted view is that to be regarded as a significant new impact, traffic noise would have to be increased by about 3dB, the smallest change that can be reliably noticed by the casual listener.

6.3 Comparison to General Environmental Noise Criteria

In the case of landfill sites, the Ministry of the Environment has determined a maximum sound level beyond which, the Ministry feels no landfill operation should operate in terms of noise. This is the 55 dB Leq level for residential areas which is referred to in this report. Usually, locations surrounding a landfill operation are found to be well below this level for much of the life of the site, approaching 55 dB for only short periods when landfilling is closest.

A more general noise impact measure is the extent to which the landfill noise exceeds the traffic noise with both sounds measured in terms of their Leq. Also a consideration, is the amount of time that the sound levels of the landfiling are elevated above the traffic background noise. (A general description of noise impact versus the increase in sound levels is given in Appendix II. The relevant data is plotted in Figure #4, which shows the landfill noise and the traffic noise. It is anticipated that for the residences located along the First Line, the sound of landfiling will be 2 to 3 dB above the background sound level for a period of 3 to 4 years. Under the rating scheme outlined in Appendix II, the noise impact of the

landfill site on the area where significant impact is anticipated would be no impact to low impact for 16 years of operation, low to medium impact for the 3-4 years when the level peaks at 55 dB, and high impact for the two, 8 week periods in which the berm is either being assembled or disassembled. Overall the impact would be rated low to moderate for the 7 residences within 500m of the actual landfilled area in the southwest corner of the site.

The noise of landfill traffic coming to the site has already been commented upon using the generally accepted basis of assessment rather than using a special criterion for landfill sites. In this case, the noise impact of landfill traffic is very low.

NOISE IMPACT SUMMARY CHART

TIME PERIOD	LANDFILL NOISE	TRAFFIC NOISE
OUTSET - 8 WEEKS BERM CONSTRUCTION	HIGH IMPACT	NIL
FIRST 15 YEARS OF FILLING	NIL TO LOW	LOW
3 TO 4 YEARS OF FILLING	LOW TO MEDIUM	LOW
LAST YEAR OR TWO OF FILLING	NIL TO LOW	LOW
REMOVAL OF BERM -8 WEEKS	HIGH IMPACT	NIL

7.0 RECOMMENDED MITIGATION MEASURES

To ensure that the site operates within the guidelines of the Ministry on The Environment, the following mitigation is required:

1. A berm of elevation and location shown in Figure 2 must be erected along the southern property line starting from a point 200 meters west of the right-of-way at the First Line, then continuing to the west and turning north parallel to First Line to a point 250 meters north of the settling pond shown in Figure #2.

2. All off-road equipment used on the site must meet 85dB maximum sound level at 15m measurement distance as per the Ministry of the Environment's Publication NPC - 115 of the Model Municipal Noise Control Bylaw.

APPENDIX I

BERM ASSEMBLY PROCEDURE

The approach to berm assembly is intended to minimize the noise emissions in the vicinity of the homes on the west side of the 1st Line. The goal is to reduce the time that the powered equipment spends running on top of the excavated material. Work would start approximately one half way down the site in the area of the lagoon (see figure 2 in the main text) working northward. Ramps maintained at intervals of 150 metres or so on the landfill side of the berm, would allow minimum time on the berm for each circuit by the scrapers.

Once the north end was constructed, the south end would be built starting at the halfway point and working southward. Again, ramps from the landfill area side of the berm can be utilized to minimize the length of time that a machine spends on top of the berm, reducing its noise (and dust) contribution toward the west.

WORKSHEET #1

NOISE MODEL FOR SITE D

$$Leq = 10 * \log(\sum (10^{L_{pn}/10} * P_n))$$

where L_{pn} is the A-weighted sound pressure level

P_n is percentage of time interval

Equipment type and duration of operation

2 packers @ 45 minutes each = 90 minutes

Sound level @ 15m = 84 dBA

30 trucks @ 2 minutes each = 60 minutes

Sound level @ 15m = 84 dBA

2 scrapers @ 20 minutes = 40 minutes

Sound level @ 15m = 84 dBA

COMBINED LEVELS

$$\begin{aligned} Leq &= 10 * \log(10^{84/10} + 10^{84/10} + 10^{84/10}) \\ &= 89 \text{ dBA @ 15m} \end{aligned}$$

Leq at 30m

$$\begin{aligned} Leq &= 89 - 20 * \log(30/15) - 1 \text{ (ground effect over extra 15m)} \\ &= 82 \text{ dBA} \end{aligned}$$

Leq at 500m

$$\begin{aligned} Leq &= 89 - 20 * \log(500/15) - 8 \text{ (ground effect over 500m)} \\ &= 50.5 \text{ dB} \end{aligned}$$

WORKSHEET #2

SOUND PROPAGATION - SITE D (see cross section, figure 3)

Reference sound level: 82 dBA @ 30m
(see Worksheet #1)

Leq at Receiver = Reference sound level
- Attenuation (distance and ground effect)

Point A: 82 - 33 = 49 dBA (Computer printout #1)
Point B: 82 - 28 = 54 dBA (Computer printout #2)
Point C: 82 - 28 = 56 dBA (Computer printout #3)

where Point A is at bottom of fill
Point B is at middle of fill
Point C is at top of fill
(see Fig #3)

Printout 1

SOURCE ID: HALTON EPA SITE D POINT A FIGURE #3
SOURCE TO BARRIER DISTANCE= 55
RECEIVER TO BARRIER DISTANCE 107
RECEIVER ELEVATION 181.5
SOURCE ELEVATION 182
LOWEST ELEVATION SOURCE TO RECEIVER 180
LOWEST ELEVATION SOURCE TO BARRIER 180
LOWEST ELEVATION BARRIER TO RECEIVER 180
TOP OF BARRIER ELEVATION 188
SOURCE/BARRIER DIST. 55.3263048
RECEIVER/BARRIER DIST. 107.197248
SOURCE/RECEIVER DIST. 162.000772
PATH LENGTH DIFF. .522781312
EFFECTIVE HEIGHT PREBARRIER 3.5
EFFECTIVE HEIGHT W/BARRIER 19.5
SOURCE TYPE P
FRESNEL#= 1.51971312 BARRIER ATTEN= 15
NORMAL ATTENUATION= 23.3363446
ATTEN W/BARRIER = 32.8691014
BARRIER INSR/LOSS= 9.53275682

Printout 2

SOURCE ID: HALTON EPA SITE D POINT B FIGURE #3
SOURCE TO BARRIER DISTANCE= 113
RECEIVER TO BARRIER DISTANCE 107
RECEIVER ELEVATION 181.5
SOURCE ELEVATION 191
LOWEST ELEVATION SOURCE TO RECEIVER 180
LOWEST ELEVATION SOURCE TO BARRIER 180
LOWEST ELEVATION BARRIER TO RECEIVER 180
TOP OF BARRIER ELEVATION 188
SOURCE/BARRIER DIST. 113.039816
RECEIVER/BARRIER DIST. 107.197248
SOURCE/RECEIVER DIST. 220.205018
PATH LENGTH DIFF. .0320460796
EFFECTIVE HEIGHT PREBARRIER 12.5
EFFECTIVE HEIGHT W/BARRIER 28.5
SOURCE TYPE P
FRESNEL#= .0931572082 BARRIER ATTEN= 8
NORMAL ATTENUATION= 23.3413764
ATTEN W/BARRIER = 28.008416
BARRIER INSR/LOSS= 4.66703959

SOURCE ID: HALTON EPA SITE D POINT C FIGURE #3

SOURCE TO BARRIER DISTANCE= 170

RECEIVER TO BARRIER DISTANCE 107

RECEIVER ELEVATION 181.5

SOURCE ELEVATION 200

LOWEST ELEVATION SOURCE TO RECEIVER 180

LOWEST ELEVATION SOURCE TO BARRIER 180

LOWEST ELEVATION BARRIER TO RECEIVER 180

TOP OF BARRIER ELEVATION 189.5

SOURCE/BARRIER DIST. 170.323956

RECEIVER/BARRIER DIST. 107.298649

SOURCE/RECEIVER DIST. 277.617093

PATH LENGTH DIFF. 5.51211834E-03

EFFECTIVE HEIGHT PREBARRIER 21.5

EFFECTIVE HEIGHT W/BARRIER 40.5

SOURCE TYPE P

FRESNEL# = .0160235998 BARRIER ATTEM= 6

NORMAL ATTENUATION= 24.0534513

ATTEN W BARRIER = 27.1985885

BARRIER INSER/LOSS= 3.14513724

WORKSHEET #4
TRAFFIC NOISE

Traffic volume on Highway #25 = 8000 vehicles AADT 1985
Assume 5% heavy trucks, 5% medium trucks
Percentage of vehicles during landfill operating hours = 80%
Number of hours per day traffic to landfill is significant = 10 hours
General traffic volume while landfill is operating = 640 vehicles
576 light vehicles 32 medium trucks 32 heavy trucks

Landfill traffic = 40 heavy truck * 2 passbys from north per day
 = 170 heavy truck * 2 passbys from south per day
Note: Other landfill traffic has negligible contribution to total noise

Average number of heavy landfill trucks passbys per hour
 = 8 to north
 = 34 to south

New traffic with full volume including landfill traffic
 = 576 light, 32 medium trucks, and 40 heavy trucks to the north
and = 576 light, 32 medium trucks, and 68 heavy vehicles to south

Using NT&C AE-82-05 prediction procedure

$$Leq = 10 \log(5.32 \cdot V \cdot S \cdot K \cdot D^{-1.5})$$

$$K = P \cdot S / 1040 + Q \cdot S / 9.6 + 23.5 \cdot R / S$$

V=Total vehicles per hour

S=Average traffic speed

D=Distance from roadway centreline to receiver

P=percentage light vehicles

Q=percentage medium trucks

R=percentage heavy trucks

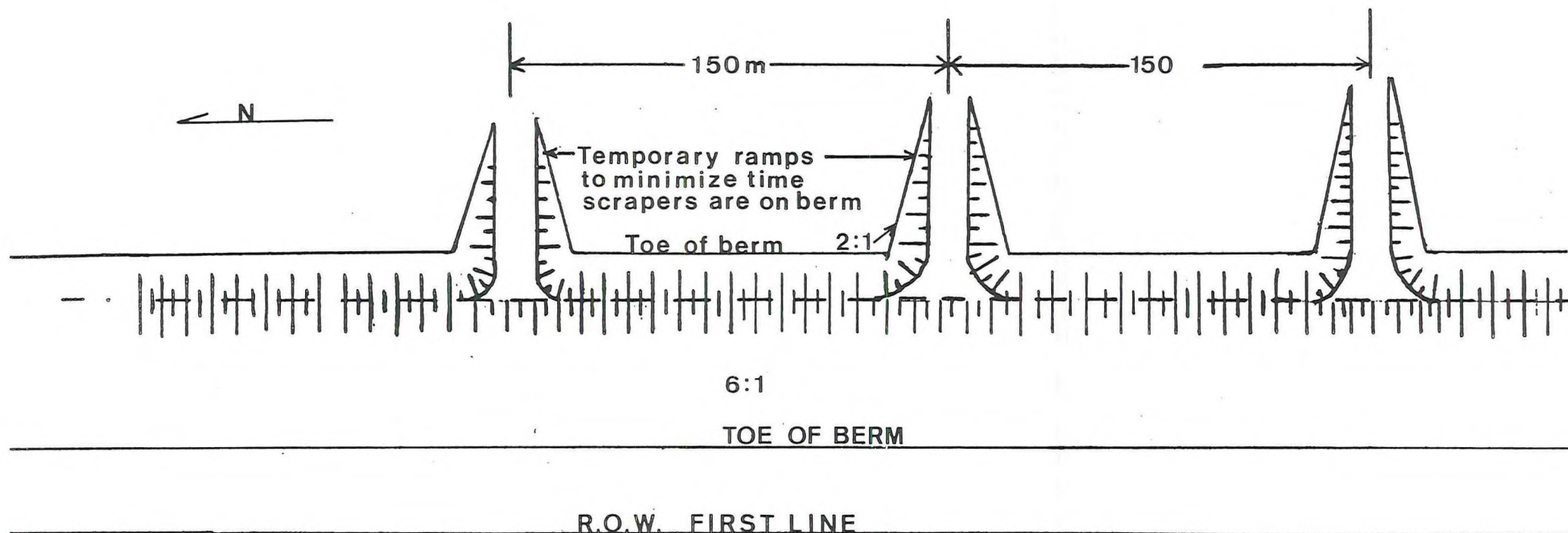
Comparing results of the the above equation for the different traffic volumes

The sound level to the south increases approximately 1.5 dB
The sound level to the north increases approximately 0.5 dB

At the turn off, the equation is modified by increasing the heavy truck factor in the equation for K by 40%

$$K = P \cdot S / 1040 + Q \cdot S / 9.6 + 33.2 \cdot R / S$$

With the modified equation applicable to 200m north and south of the turn-off, the sound levels along Highway #25 increase
Approximately 1 dB to the north, and 2 dB to the south



Halton Landfill Site D

Figure A1 PLAN
Western Berm Assembly Using
Ramps at 150 Metres Centres
to minimize Noise

APPENDIX II

EXPLANATION OF TERMS

ENVIRONMENTAL NOISE DESCRIPTORS

Many indices have been proposed to describe sound levels in a neighbourhood. To simplify matters the following explanations are provided.

L₉₀

The L₉₀ describes the background noise or the lowest levels of sound in the neighbourhood. Only 10% of the time are the sound levels below L₉₀, and rarely by more than 2-3dB.

L_{eq}

The L_{eq} is an average sound level which is quite sensitive to short, loud sounds. Thus, it is sensitive to events which stick out of the "sound scape".

The following explanation is provided to assist in the assessment of changes in community sound levels where such changes are indicated by an increase in the L_{eq} or average sound energy index.

1dB CHANGE

For sounds presented to a listener one immediately following the other, a 1dB change is the smallest increment which can be reliably detected by most people. If the time delay between presentation of the sounds is more than a few seconds, the change is not reliably detected (ie. the community is not sensitive to a 1dB change occurring over 1 year's time). In environmental noise 1dB change occurs with an increase in traffic of 25% or typically every 5 years in stable growth areas.

3dB CHANGE

An increase in the L_{eq} of 3dB is reliably detected by most listeners and is the smallest change considered significant by most planning authorities. It is also the smallest change in the overall L_{eq} (all sounds combined) which can be reliably detected by standard noise monitoring techniques. A doubling of

5dB CHANGE

An increase in the overall L_{eq} of 5dB represents a relatively significant impact in terms of overall L_{eq} , particularly if an area is already at, or above daytime L_{eq} of 55.

10dB CHANGE

A 10dB increase in overall L_{eq} represents a doubling in the loudness of the sound and represents a major impact on an urban community especially if the levels are already above 50 dB L_{eq} .