AGRICULTURAL CHARACTERISTICS AND IMPACTS OF THE PROPOSED HALTON REGION LANDFILL SITE D

Prepared for:

TOWN OF MILTON

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EXECUTIVE SUMMARY

The purposes of the report on the agricultural characteristics and impacts of the proposed Halton Region Landfill Site D are to:

* describe the agricultural characteristic of the site

* assess the impact of the proposed landfill on agriculture

* state our opinion about the proposed rehabilitation of the site to an agricultural after-use

* relate these agricultural issues to the Food Land Guidelines. These Guidelines are Ontario Government policy which direct planning decisions to encourage the preservation of good agricultural land.

The report utilitizes three levels of analysis. The first reviews the factors used to rate the quality of farmlands. The second outlines the site-specific agricultural characteristics of site D with a brief comparison to proposed site F. The third evaluates the effectiveness of the proposed rehabilitation of the site to an agricultural after-use.

Although proposed site F is in an area designated for urban use, a comparative analysis of its agricultural characteristics is included.

why? compare agric. char. of D + F

The results of this report indicate that:

1) Agriculture in Halton Region makes a significant contribution to the local economy;

2) Site D is in an area of active agricultural use;

3) Site D is constituted by Class 1 through 3 agricultural lands, which the Food Land Guidelines identify as lands of agricultural potential which should be preserved;

4) The proposal to landfill on Site D and rehabilitate to an agricultural after-use will result in negative impacts on this agricultural resource:

   a) the rehabilitated site's production potential will be reduced. Post-development yield as a % of a pre-development yield is 59-65%, expressed in terms of grain corn yield. Alternatively, what was 100% class 1 through 3 will become predominantly class 3 and 4.

   b) the landfill proposal may create additional negative agricultural impacts, such as:

      * a non-agricultural intrusion in an agricultural community

      * interference with machinery movement and access

      * nuisance such as noise, bird damage, fear of gas explosion, possible contamination of down gradient wells or surface water

In summary, because of both long term (loss of soil capability) and short term impacts (during the life of the landfill) this assessment indicates that, in compliance with the Food Land Guidelines, the proposed landfill should be accommodated, if possible, on lands unsuitable or of lower priority for agriculture.

1.0 INTRODUCTION

1.1 Terms of Reference

Smith, Hoffman was retained by the Town of Milton to review the impact of the proposed Halton Landfill on agriculture. Our work was to include:

i) a review of the agricultural documents prepared for the Landfill Environmental Assessment

ii) an assessment of the agricultural characteristics and potential impacts on agriculture of the landfill proposed on site D

iii) our opinion concerning the proposed rehabilitation to an agricultural after-use for site D.

1.2 Report Format

This report has been divided into sections that address each of these objectives. 1 Section 2.0 describes agricultural activity in the Region of Halton and reviews current methods used to differentiate levels of agricultural activity and therefore potential impact. 2 Section 3.0 reviews the site specific characteristics of the proposed sites D and F. This work includes the data compiled from field studies. 3 Section 4.0 addresses the proposed rehabilitation of site D including a literature search on the state-of-the-art in agricultural rehabilitation.

Conclusions are stated at the end of each section and a summary of the overall report is found in Section 5.0.

2.0 AGRICULTURAL OVERVIEW

2.1 Potential Landfill Site Impact Differentiation

The Food Land Guidelines were issued in 1978 and have continued to be used as provincial Government policy to implement its committment to the maintenance of "a permanent, secure, and economically viable agricultural industry for Ontario, not only as a producer of food, but as an important component of our economic base, a source of employment, and the basis of the rural community and the rural way of life".

The Food Land Guidelines describe a method for differentiating the better from the poorer lands and list a number of criteria which need to be considered when planning decisions must be made concerning land with good agricultural potential.

These good lands with agricultural potential include:

1. Lands with a capability for the production of specialty crops.
2. Class 1 to 4 soils as defined in the Canada Land Inventory of Soil Capability for Agriculture.
3. Additional areas where farms exhibit characteristics of ongoing viable agriculture.
4. Additional areas where local market conditions ensure agricultural viability where it might not exist otherwise.

The Guidelines state that these lands need to be identified, designated in official plans and supported by policy. Within the Guidelines, discussion on the rating of land includes an examination of more specific social, economic, and physical characteristics. These characteristics and others which have been derived in response to the Ontario Ministry of Agriculture and Food's (OMAF) requests under the Environmental Assessment Act or the Planning Act, are listed in Figure 1.

A review of the Figure shows that up to 10 main factors have been examined. Of these, the Region of Halton's Landfill E.A. at stage 2C addresses 8, which were divided into two factors of 1 "long-term agricultural viability" and 2 a second which comprised "land quality, large contiguous blocks of agricultural land and special farm enterprises". Using this information, site D was rated as having a relatively high impact on long term agricultural viability while site F had a relatively low impact. In the second tier of impact analysis, site D had an average medium impact while site F had an average low impact. The relative rating of the six site plan areas using both levels of impact showed site F as most preferred as a landfill site (ranked no. 1) and site D as fifth ranked out of six sites.

This rating is supported by information collected and analyzed by the Region of Halton (1987) in its report Agricultural Land Evaluation System. The system rated lands using 8 main criteria and 19 specific criteria which are listed in figure 1. The criteria were subsequently weighted and a numerical system used to rate lands throughout the Region. The system was reviewed and the ranking of categories determined by The Halton Agricultural Advisory Committee. The system was also reviewed by the Niagara Escarpment Commission and the Ontario Ministry of Agriculture and Food. The Region's Report concludes about the comments of external reviewers that "while further refinements are possible, it would appear that the consensus of opinions is now that the results of the Halton

CHARACTERISTICS	DESCRIBED IN FOOD LAND GUIDELINES	LIS E.A. C	HALTON LANDFILL E.A.
CAPABILITY -for production of specialty crops	-soil and/or climatic capability specialty crops	-soil crops	
-for production of agricultural products	-protect land with Class 1-4 soil capability as determined in CLI	-soil ses rated. accor& 7 rated as clas	-area of soil capability classes expressed as a %.
Climate	-climate		
Crops and Livestock	-additional areas of ongoing viable agriculture -areas where local markets ensure agricultural viability	-existialty crops cultural -# linsity	-large contiguous blocks of agriculture lands -special farm enterprises -livestock -depth of overburden -long term viability
Capital Investment in Agriculture	-special markets -continuous blocks of agri-cultural land -concentrations of capital investment (-stone removal, drainage systems, irrigation systems, dyking, fertility improvements.) -Farmer management -skills specialized techniques	-buildtation -draings (number, -clearion) -cons -irri -crops	-# of farms -land use adjacent and withing 0.5 mile of candidate site -area farmed
Ownership/Tenure farm Type & Parcel Sizes	-fragmentation -parcel sizes	-ownerarmland -full farme -fragmlation s non-farm ed land	-# owner operated farms -owner operated farm areas -hobby farm -farm rental area
Impact on Off-Site	-identify & minimize impacts	-waternsitive -surfa drain land use -increses on faes -air, t -effec to fa -incre -incre -restr or ma	-potable water for downstream, livestock & residential needs -potential bird problems -access
Impact on Agri-cultural Community	-identify & minimize impacts	-feed on outle farm pop- -homogator age, commufarmers) -trans -barrivenue	-unfragmented agricultural land -ownership and severance patterns -land uses
Adjacent Land Uses	-official plan designation -zoning -land uses-compatibility -non-farm uses -sewer water expansion -land consumption rates -population growth	-# & l design- -offic polic -sewer -propo	-offical plan designation -proposed highways -planned urban growth
Spin - Off Effects		-possi patte -demand -impact	
Need	-availability of alternative locations on poorer agri-cultural lands -reasons why considered unsuit-able	f sites	-comparison of sites -after use concerns on-site
Misc			
Total Major Factors	10		8
Total Detailed Factors	25		22

Agricultural Evaluation System appear reasonably accurate and supportable".

The mapped results of the evaluation are outlined in figures 2 and 3. The figures show that:

(1) land can be divided into classes which differentiate the better from the poorer lands for long term agriculture.

(2) the site proposed for landfill in Milton (site D) is located in the area with a relatively high potential for agricultural use.

The data summarized on the map is also supported by statistical information available from the Ministry of Agriculture and Food (OMAF) and summarized in the following section.

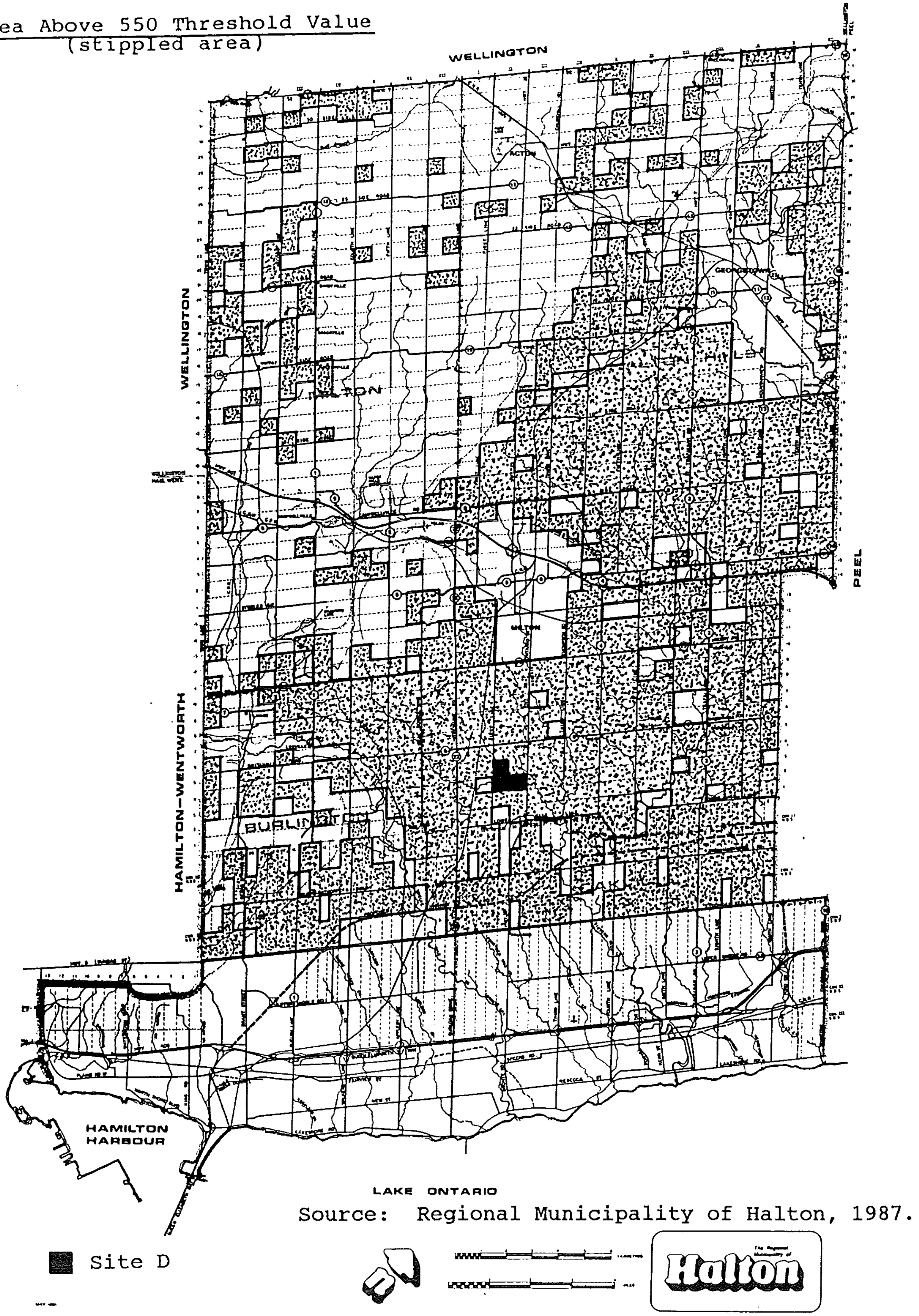
2.2 Agriculture in Halton

The general value of agriculture within Halton has been outlined within a report presented by the Halton Federation of Agriculture (H.F.A.) to Halton Regional Council. (Appendix 1)

Figure 2

Land Evaluation Map - Region of Halton

Area Above 550 Threshold Value
(stippled area)

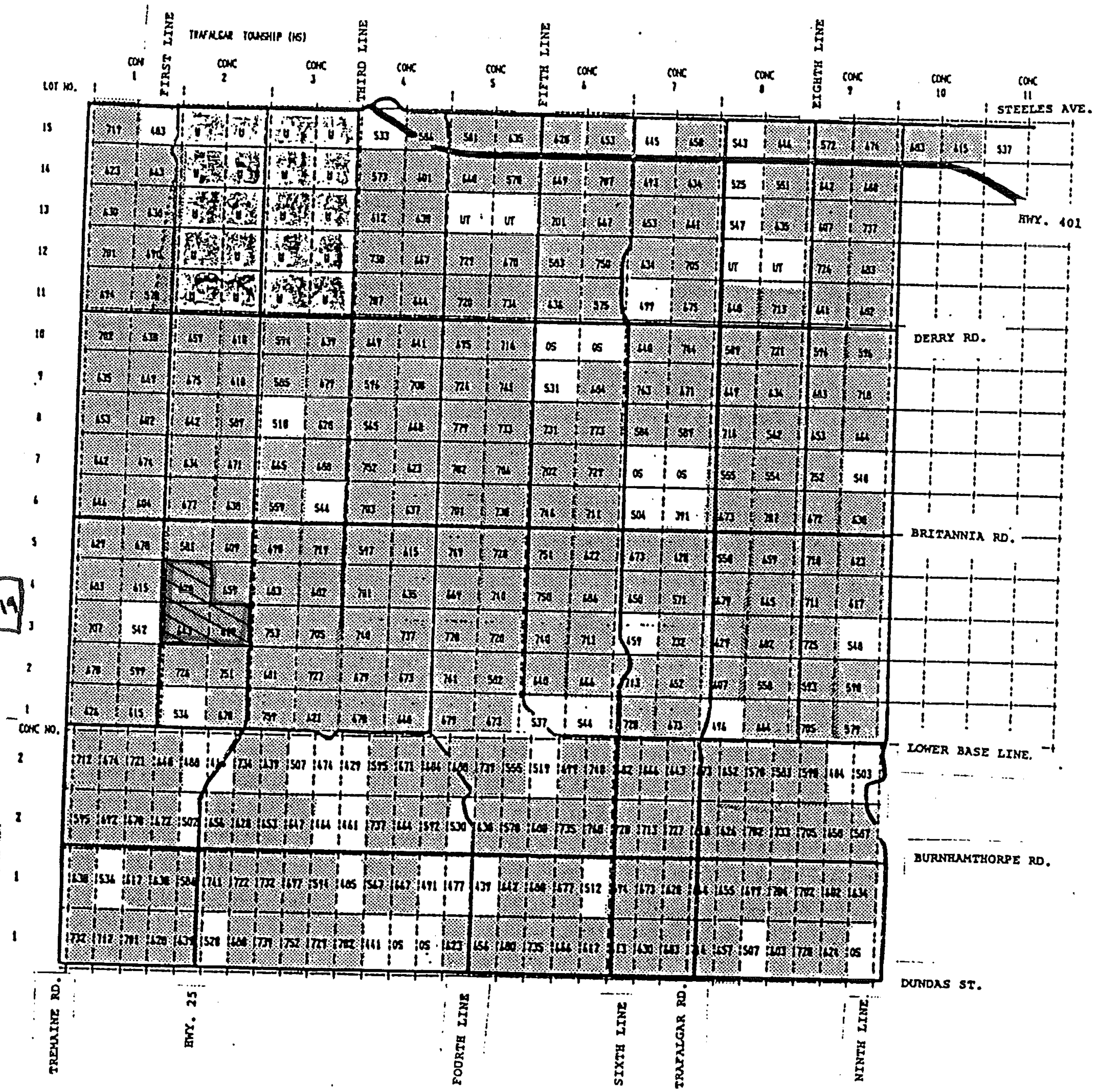


Source: Regional Municipality of Halton, 1987.

Site D

Figure 3

Land Evaluation Map - Former Trafalgar Township



678

643 619

Site D

Source: Regional Municipality of Halton, 1987.

The H.F.A. supports the view that agriculture is active in Halton and contributes significantly economically and socially to the Region. The following data adds to that viewpoint.

Statistical information from the years 1980 - 1985 (OMAF 1981, - 1986) show trends and are based on Halton County-wide data. Boundary changes in counties or Regions over time have resulted in some data changes. However, these changes do not prevent the use of the data to indicate general yearly trends on a County-wide basis.

The following factors summarize the data:

1 * the amount of improved farm land, the number of farm owners and the amount of land farmed by owners has increased in Halton between 1976 and 1981 (figure 8). p.15

2 * Halton ranks 22 out of 42 counties or districts in Southern Ontario in terms of total value of census farm sales (1981).

3 * Halton ranks 19 out of 42 counties or districts in Southern Ontario in terms of capital value of census farms (1981).

4 * area in census farms has increased as has the area under crops in Halton from 1971 to 1981 (figure 6) (figure 7). (Note - the $ value definition for census farm was increased in the 1981 census - see glossary)

5 * Yields reported by farmers in Halton (1985) for barley, winter wheat, hay, oats and fodder corn are average to above average for Western Ontario and above average for the Province. Grain corn yields are below average.

6 * crops grown in Halton are predominantly common field crops. Specifically, grain corn production predominates and has been relatively constant with some increase in production in 1984 - 1985. Barley production has dropped while winter wheat has increased (figure 4).

7 * livestock production is relatively constant with some decline in cattle. Chicken production is higher (figure 5).

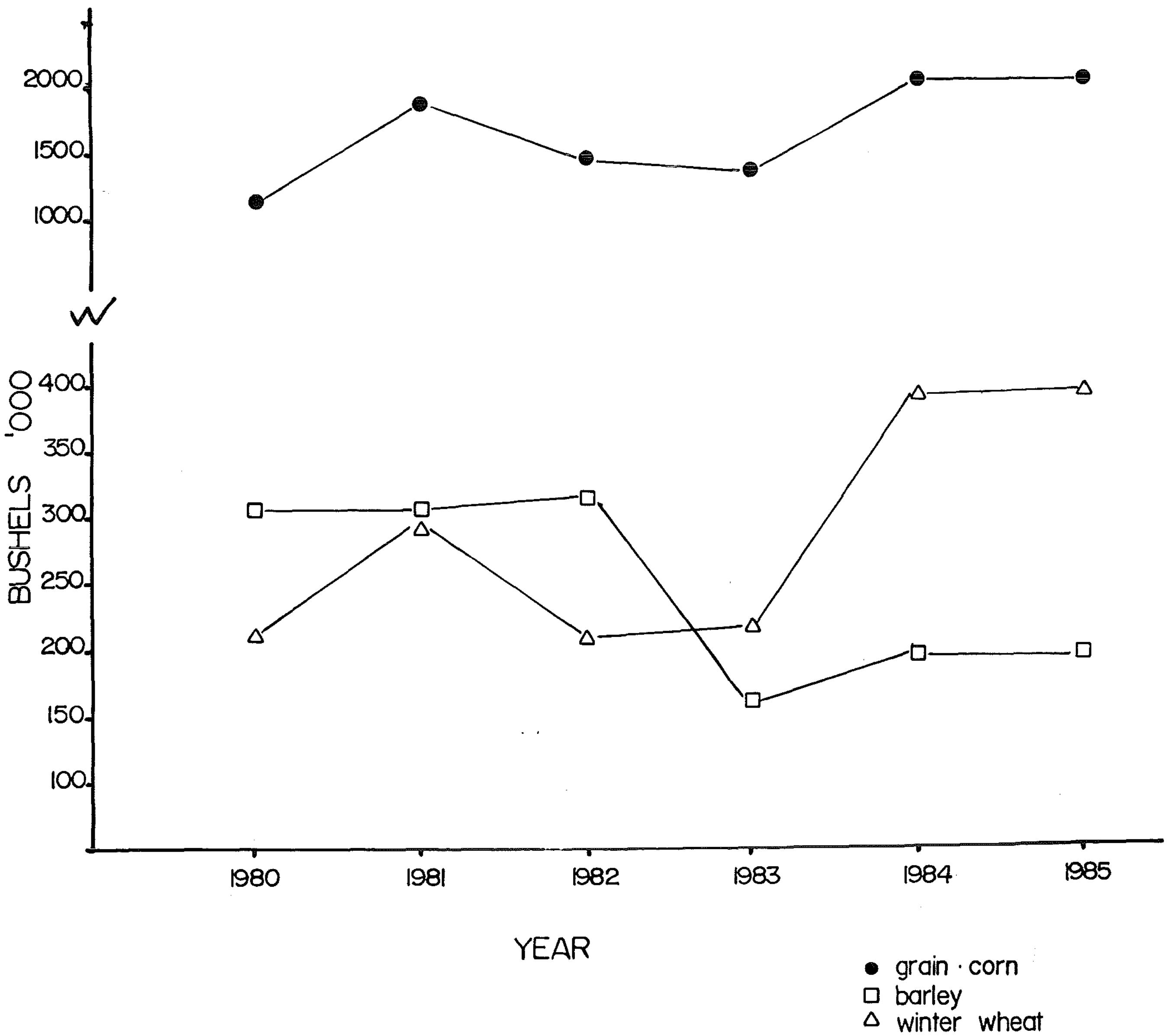
8 * hay and grain corn occupy the largest acreage of land relative to other crops (figure 6)

9 * soybean production, while comprising only about 1% of total farm cash receipts, is increasing. Acreage was approximately 1728 in 1981 and has increased to 4500 in 1986. (P.E. MacMaster, personal communication, 1987).

10 * Rural farm population, and Rural non-farm population has decreased in Halton between 1976 and 1981 (figure 8).

Figure 4

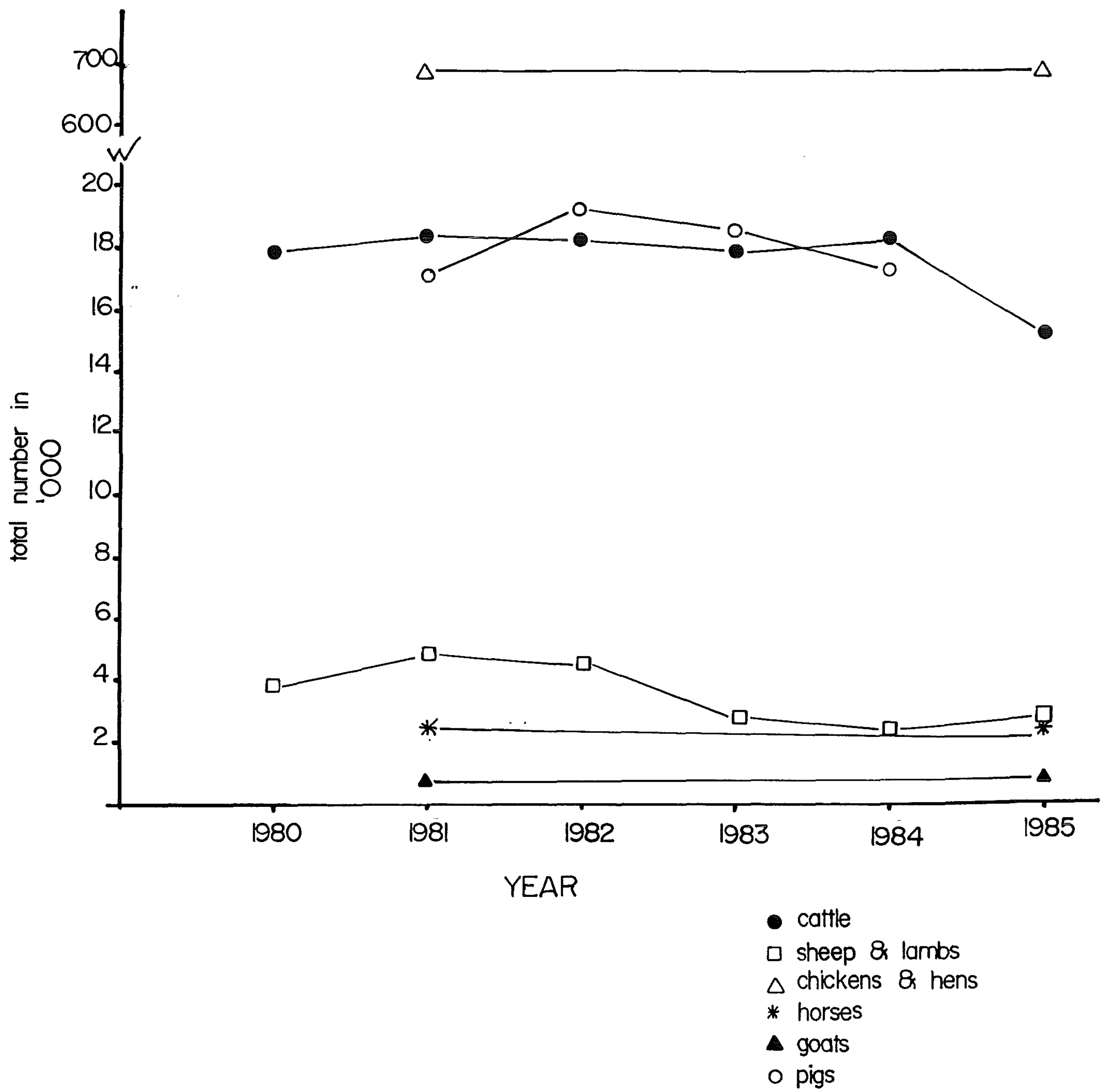
Field Crop Production in Halton



Source: Ontario Ministry of Agriculture and Food
Agricultural Statistics 1980 - 1986

<u>Figure 5</u>

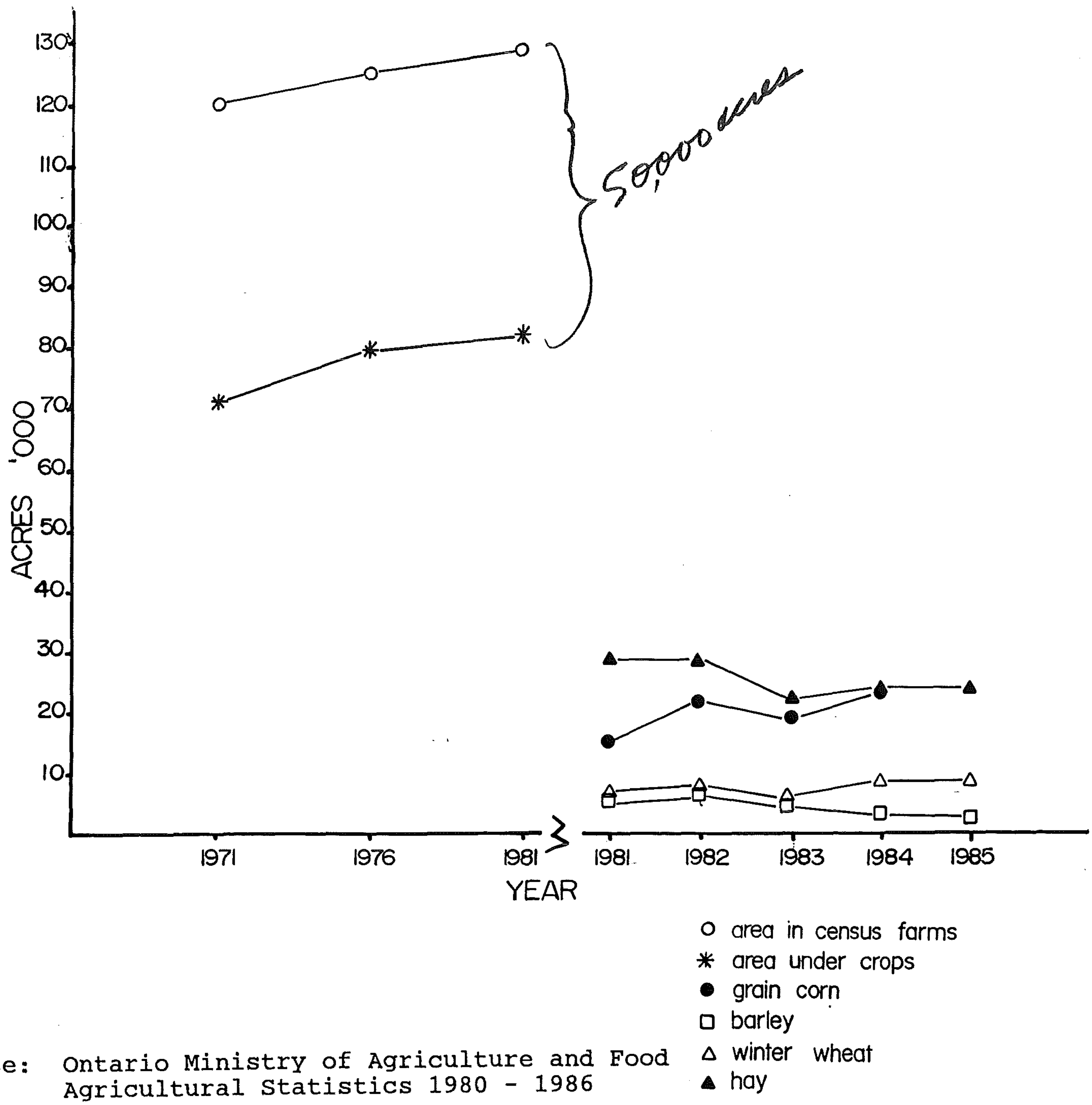
Livestock Production in Halton



Source: Ontario Ministry of Agriculture and Food
Agricultural Statistics 1980 - 1986

Figure 6

Farm Acreage in Halton



Source: Ontario Ministry of Agriculture and Food
Agricultural Statistics 1980 - 1986

from OMAF data (summarized annually)

Figure 7 Data on Farm Population and Land

the better new not 11000 acres

Parameter	1971 a	1971 b	1971 c	1976 a	1976 b	1976 c	1981 a	1981 b	1981 c
Number of census farms	1,066	28,381	94,722	1,035	26,373	88,801	969	25,151	82,448
Area of census farms (acres)	120,971 ~~12,097~~	4,649,266	15,963,056	125,792	4,498,671	15,473,011	3288 acre gain 129,030	4,395,224	14,923,280
Farm population			≠ 47,699	3,750	101,911	341,113	3,258	89,606	288,743
Rural non-farm population				19,680	248,629	1,214,852	18,640	285,548	1,298,249
Total Population				228,495	1,508,420	8,264,465	253,883	1,691,825	8,625,107
IMPROVED LAND AREA									
Under crops	70,876	2,438,731	7,855,890	78,378	2,765,645	8,665,845	81,195	2,879,164	8,976,664
Pasture				13,445	669,344	1,836,696	11,036	557,895	1,623,506
Summer fallow				4,455	46,309	186,652	3,372	40,296	156,440
Other				5,257	106,812	380,150	6,417	114,140	408,977
Total	97,539	3,544,270	10,864,601	101,535	3,588,110	11,069,343	102,720	3,591,495	11,165,587
UNIMPROVED									
Woodland				11,742	437,433	2,057,471	14,989	422,045	1,834,240
Other				12,515	473,128	2,346,197	11,302	381,788	1,923,688
Total				24,257	910,561	4,403,668	26,291	803,833	3,757,928

* a = Halton b = Western Ontario c= Ontario

census farm def. diff from 1976 and 1981

Figure 8 ← Stats Can.

Farm Population and Tenure

	1976		1981	
	Province	Halton	Province	Halton
% living on farms	4.1	1.6	3.4	1.2
Number of farms	~~88,801~~ 76,983	~~1,035~~ 796	82,448	969
Owners	50,865	415	55,206	592
Tenants	4,403	136	4,890	134
Part owner / part tenant	21,715	245	22,352	243
Total farm area (ha)	5,966,816	47,699	6,039,237	129,030
Area classified by tenure of operator (ha)				
owner	3,030,247	12,916	2,951,241	16,898
tenant	286,376	9,502	257,195	10,432
part owner / part tenant	2,650,193		330,805	24,887
Total area owned	4,571,745	22,507	593,989	1 24,973
Total area rented	1,395,070	25,192	1,445,252	2 27,244

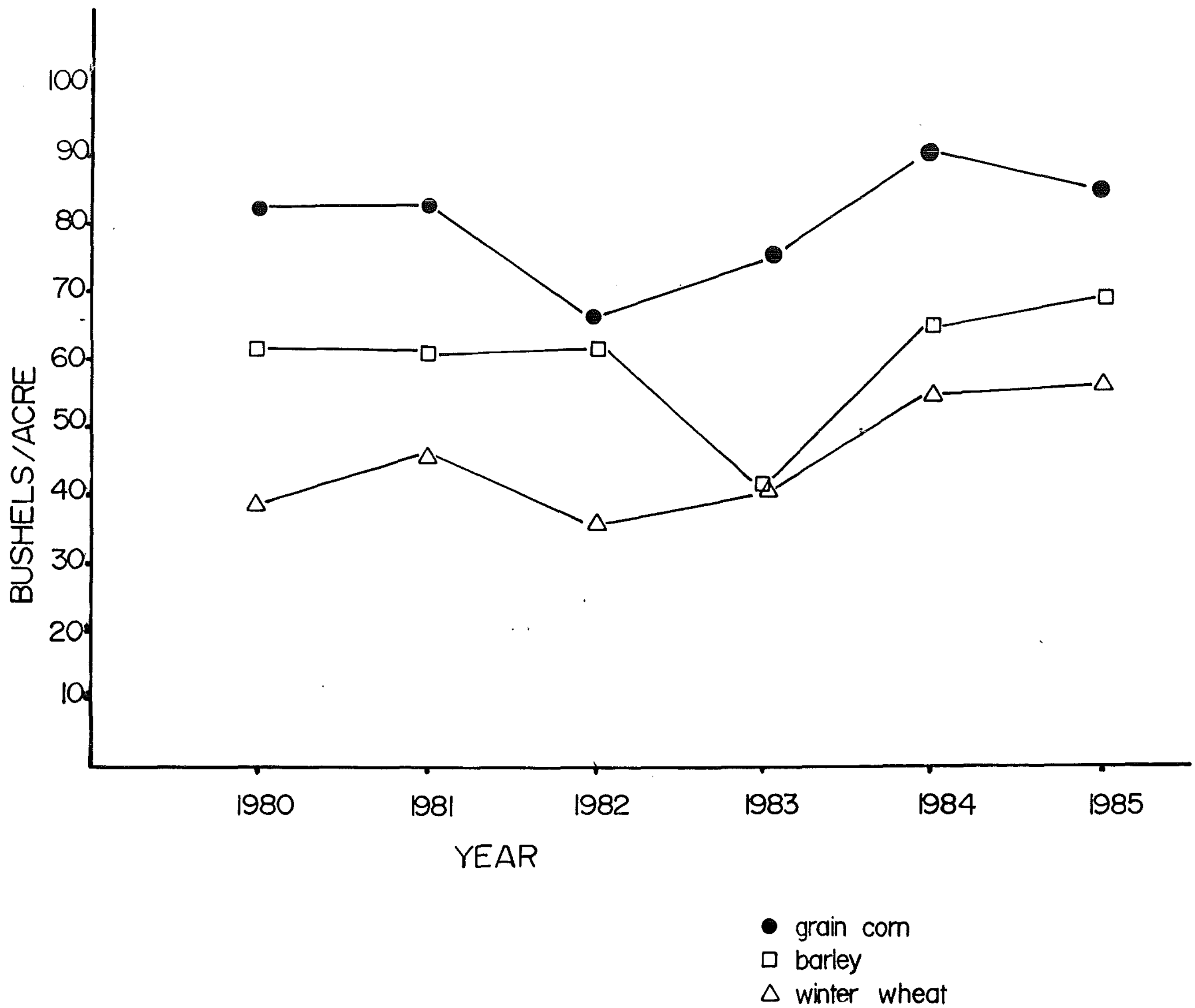
52,217 ha

~~more~~ less tenant farmers

= 52,217 ha (or 11,000 acre increase)? from 1976-1981

Figure 9

Crop Yields in Halton



Source: Ontario Ministry of Agriculture and Food
Agricultural Statistics 1980 - 1986

These data show that agriculture in Halton is average to above average relative to other counties in Southern Ontario.

2.3 Conclusions

Halton's agricultural areas are producing crops at average to above average yields. Some areas are better producers than others and have a higher potential for long term agriculture. Site D occupies an area of high agricultural potential as well as use.

3.0 SITE SPECIFIC AGRICULTURAL CHARACTERISTICS

3.1 Introduction and Methods

A reconnaissance survey of field crops, farm buildings, and residences was completed around sites D and F in the spring of 1987 by travelling roads around each of the proposed sites. As well, field work was completed on each site for agricultural crops and soils. Soils observations were made to a maximum depth of 120 cm using an Oakfield manually operated soil probe.

In addition, soil pits were dug by hand and profiles compared to existing soil maps and series names. The methods used in the soil survey are outlined in figure 10.

Each of the soil characteristics as described in figure 10 (excluding slope) were noted for three diagnostic horizons called the A (surface), B (subsurface subsoil,

Figure 10

Characteristics and Observation Methods

The soils of the two sites were mapped after inspection of boreholes made during a traverse around each of the properties. As well, boreholes were made at road cuts or at the edge of the road right-of-way. Boreholes were made manually by shovel and by use of an Oakfield probe. The soil profile was observed to a maximum depth of 120 centimetres and the following characteristics recorded.

Characteristic	Method
texture	using hand methods outlined by O.I.P. (1982) into textural classes and using particle size classes outlined in CSSC (1978).
stoniness	for surface stones into classes following O.I.P. (1982) and CSSC (1978).
slope	in % by use of clinometer and abney level. Subsequently into classes identified by an alphabetic code following CSSC (1978).
colour	recorded for soil matrix and mottles on hue, value and chroma following Munsell Soil Colour Charts (no date).
horizons	presence of different horizons following CSSC (1978).
depth	in centimetres for mottles, horizons, stones.
carbonates	depth to free carbonates observed by fizzing after application of dilute hydrochloric acid.

a zone of change or accumulation) and C (subsurface parent materials). Soils were then classified into series names such as Jeddo clay based on criteria outlined in previous soil reports (Gillespie et al, 1971; Hoffman et al, 1964).

Soil series were then mapped after photo interpretation of 1:10,000 scale black and white stereo photographs. Map symbols used in Figures 13 and 18 followed the convention outlined in Figure 14.

Soil series were subsequently interpreted for agricultural capability for common field crops into one of seven classes, where class 1 has no limitations for agriculture and class 7 is unsuitable for agriculture.

Guidelines outlined for the Canada Land Inventory (Environment Canada, 1972) as well as published soil surveys (Gillespie et al, 1971; Hoffman and Acton, 1974) were used to place soils in capability classes.

Series were also interpreted into three classes (poor, fair, and good) for six specialty crop groups following methods of Ecologistics and Smith, Hoffman Associates (1984). A single average rating of the six groups was derived using the soils series maps produced by Smith, Hoffman.

The specialty crop interpertation is limited by the lack of published climate data suitable for application to 1:10,000 scale. However, data is sufficient to state that commercial tender fruit crops cannot presently be grown successfully within the study area. NB

Agricultural crops on and around each proposed site are mapped on figures 11 and 16. The key for these map symbols is outlined in figure 19. Crops were identified in the field. Where crops were harvested, crop identification was based on stubble and seed heads missed during harvest. The mapping system used is similar to that used by the Ontario Ministry of Agriculture and Food (1983).

3.2 Site D

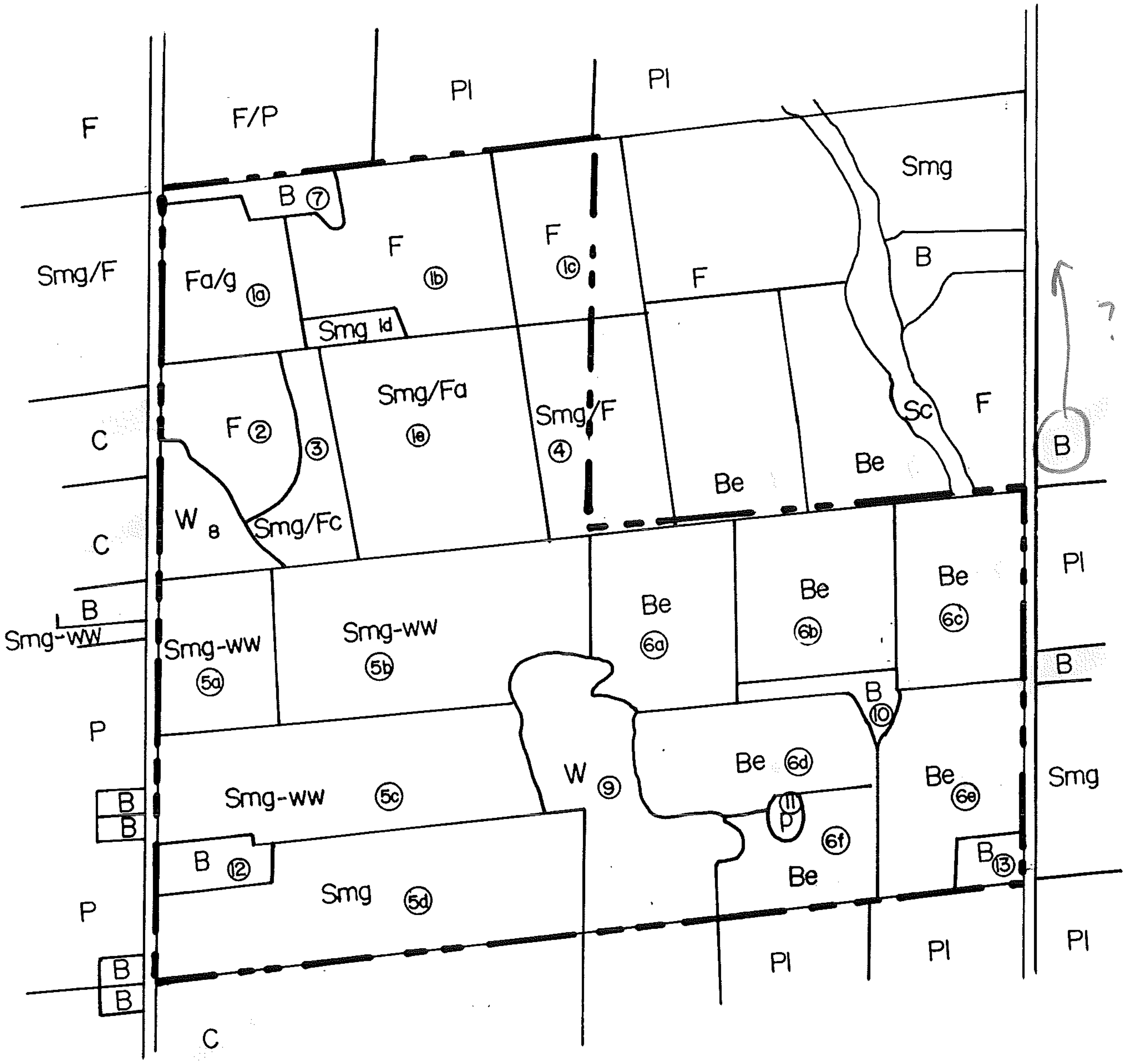
3.2.1 Land Use

The proposed site D is predominantly in active agricultural use. The 1986 cropping pattern indicates that approximately 1/3 of the site in production was winter wheat, 1/3 in soybeans and 1/3 in alfalfa forage. The crops grown are shown in figure 11.

The relative size of each cropping area has been calculated and corresponds to the data summarized in figure 12. Field sizes on site D vary from year to year depending on the crops grown. However, if fields are measured with no regard to ownership, their sizes ranges from 2 - 27 acres with a mean value of approximately 16.6 acres.

The area surrounding the proposed site is predominantly in agricultural use with common field crop or pasture lands. There is some rural residential land use, predominantly to the south and south-west of the site D.

FIGURE II CROP MAP OF SITE D



LEGEND

C	corn	Be	beans
Smg	small grains	P	pasture
ww	winter wheat	F	forage
W	wooded	g	grasses
Sc	scrub	c	clover
B	building(s)	a	alfalfa
p	pond	Pl	ploughed
2	area measurement unit		
1	maximum potential field size		
1a	possible field size		
	(as observed in 1987)		

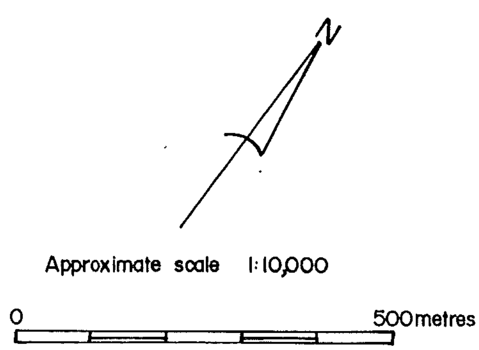


Figure 12

Agricultural Land Use Area Measurements - Site D

INDIVIDUAL FIELDS

MAP UNIT NO.	CROP		ACRES	TOTALS
1a	Forage (alfalfa and grasses)		12.33	
1b	Forage		18.21	
*1c	Forage	14.58	10.01	
1d	Small grains		2.22	
1e	Small grains undersown forage, alfalfa		24.21	66.98
2	Forage		10.75	10.75
3	Small grains undersown to forage		7.52	7.52
*4	Small grains undersown to forage	17.17	9.64	9.64
5a	Small grains - winter wheat		11.86	
5b	Small grains - winter wheat		27.06	
5c	Small grains - winter wheat		24.71	
5d	Small grains		26.57	90.20
6a	Beans		17.62	
6b	Beans		17.32	
6c	Beans		16.13	
6d	Beans		16.01	
6e	Beans		17.33	84.41
TOTAL CROPLAND				269.50

soybeans?

Other Land Uses -	Woodlots	8.28
		19.88
	Pond	0.59
	Farm buildings	2.22
		2.60
		3.95
		4.32
		41.84

TOTAL SITE 311.34 acres or 126 hectares

* Fields 1c and 4 are severed by the proposed landfill boundary. Their existing field sizes are 14.58 and 17.17 acres respectively.

3.2.2 Soils and Capability (Site D)

Soils on site D resemble the Oneida catena. This grouping of soils consists of three series called Oneida, Chinguacousy and Jeddo, which are moderately well, imperfectly and poorly drained respectively. Each has developed from a clay till. Surface textures for all soils range from clay to clay loam.

The soils have been mapped and interpreted for agricultural capability (figure 13). Generally, the site is predominantly Chinguacousy and Jeddo series and is evenly split between capability classes 1 and 3 for common field crops. Specialty crop capability is limited to Oneida and Chinguacousy soils and is restricted to a narrow range of food crops (cole crops such as broccoli and cauliflower) which can flourish in clays. Normally, specialty crops are not grown extensively on these soils. NB

Data on the relative proportion of common field crop capability is outlined in figure 15. Comparative numbers from the Halton Landfill E.A. report as well as from a map prepared for the Ontario Waste Management Corporation are included with the figure.

Figure 14

SOIL MAP UNIT CONVENTION

Map

soil series name

capability class

subclass limitation

slope class

$\frac{\text{J}}{\text{A}}$ - $\frac{\text{3D}}{\text{W}}$

$\frac{\text{On}}{\text{b}}$ - 1

$\frac{\text{On}}{\text{c}}$ - $\frac{\text{2T}}{\text{E}}$

$\frac{\text{Ch}}{\text{B}}$ - 1

Soil Series

J - Jeddo
  - poorly drained
Ch - Chinguacousy
  - imperfectly drained
On - Oneida
  - moderately - well drained

Slope Classes (%)

Aa - 0 - 0.5
Bb - 0.5 - 2
Cc - 2 - 5
Dd - 5 - 10

Capability Class and Sub-class

1 - no limitations
2T/E - limited by topography and erosion
3D/W - limited by wetness & low permeability

Figure 15

Capability Class Comparison - Site D

Capability Class	S-Hoffman Map (ha)		OWMC Map (ha)	ESP Map (ha)
1	60.34	47.9%	58.81	66.70
2	4.57	3.6%	13.45	-
3	56.31	44.7%	44.82	59.30
disturbed or ponds	4.78	3.8%	8.92	-
	126.00	100%	126.00	126.00

→ 139.6 not 126.00

3.3 Site F

3.3.1 Introduction

Data on land use and capability of site F have been included for comparative purposes. It is clear from the data described in the following paragraphs, that site F is not farm land. Halton Region did not rank the (1) lands south of Highway No. 5 (where site F is located) in its report "Agricultural Land Evaluation System". This corresponds with the low agricultural rating given (2) to it in the Halton Landfill E.A. (E.S.P., 1985). As well, the Ministry of Agriculture and Food does not, as (3) part of its normal practice, consider land within urban areas as worthy of agricultural preservation even when the land is farm land. The Food Land Guidelines (4) support this view with the statement that

> "except in circumstances where the Provincial Government decides that an important agricultural resource is involved, the Food Land Guidelines would not be applied to lands that have been designated for urban use in previously approved official plans or approved zoning bylaw which implement such plans". [S.1.6]

reasons why Site F is not farm land.

(5) soils at F not agric.

3.3.2 Land Use

Land uses around the site vary from industrial, agricultural, rural residential to hydro rights-of-way. Agricultural uses are minimal. While there are orchards still present, these have been neglected except where they have been maintained as landscaping on industrial land.

Site F is covered for the most part by former extractive areas or by wooded areas (figure 16). Agricultural uses of the area were restricted to the extreme north and south ends. Lands in the south are abandoned agricultural fields while those in the north had forage production in 1986. The total land in abandoned agriculture or in forage is about 16 hectares or 17% of site F (figure 17). Active agricultural use on the site is less than 10%.

FIGURE 16 CROP MAP OF SITE F

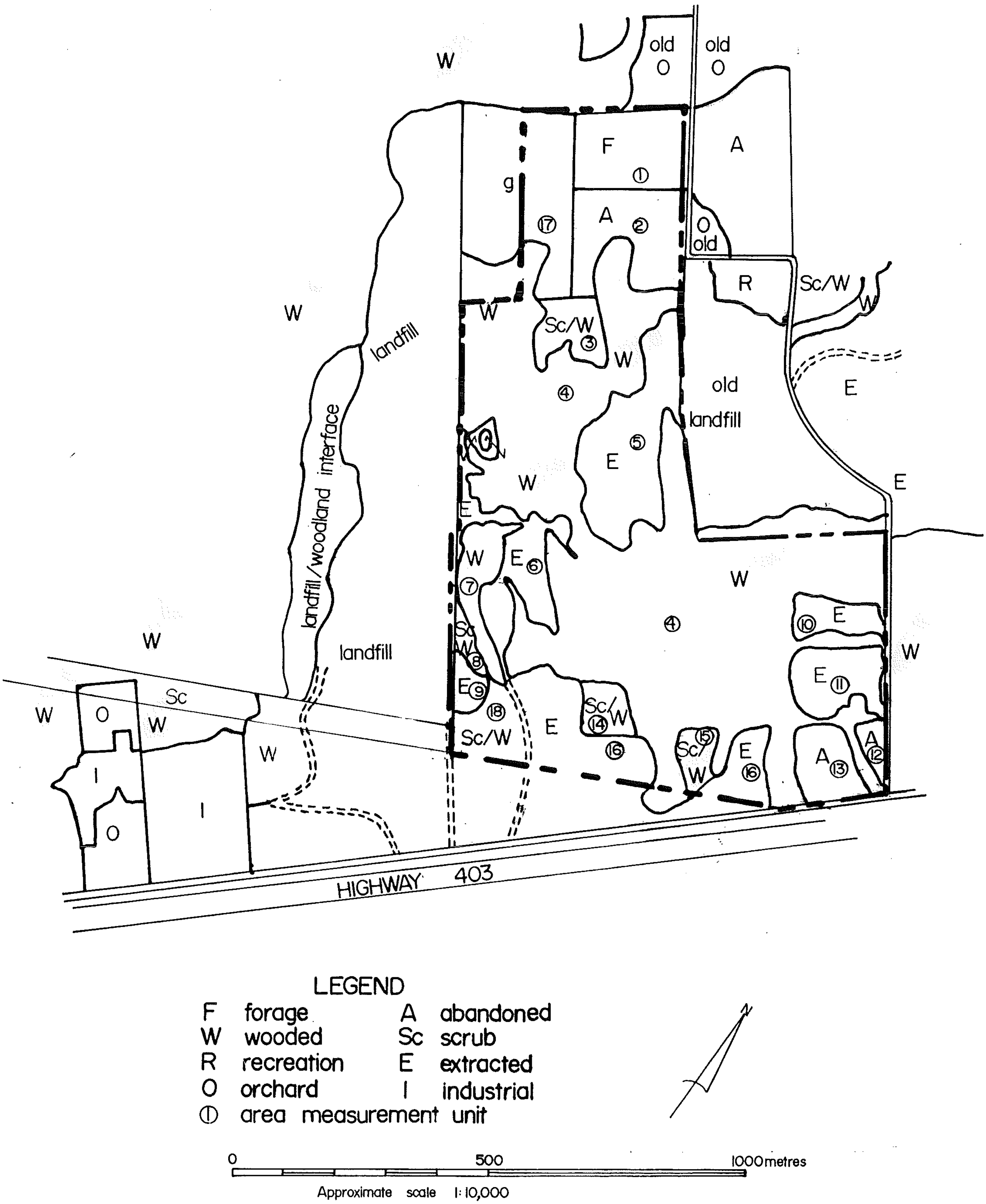


Figure 17

Land Use Area Measurements - Site F

Map Unit Number	Land Use	Acres	Hectares
1	F	11.51	4.66
2	A	12.03	4.87
3	Sc/W	4.82	1.95
4	W	110.43	44.69
5	E	16.63	6.73
6	E	10.95	4.43
7	W	5.96	2.41
8	Sc/W	2.47	1.00
9	E	2.32	0.94
10	E	3.66	1.48
11	E	6.99	2.83
12	A	2.05	0.83
13	A	5.83	2.36
14	Sc/W	3.51	1.42
15	Sc/W	2.62	1.06
16	E	19.55	7.91
17	grasses	9.76	3.95
18	Sc	6.13	2.48
	Total	237.22	96.00

Summary	ha
forage	4.66
wooded	47.10
grass	3.95
abandoned	8.06
extracted	24.32
scrub	2.48
Sc/W	5.43
	96.0

total f, g, a = 16.67
or 17.37 % of site

3.3.3 Soils and Capability

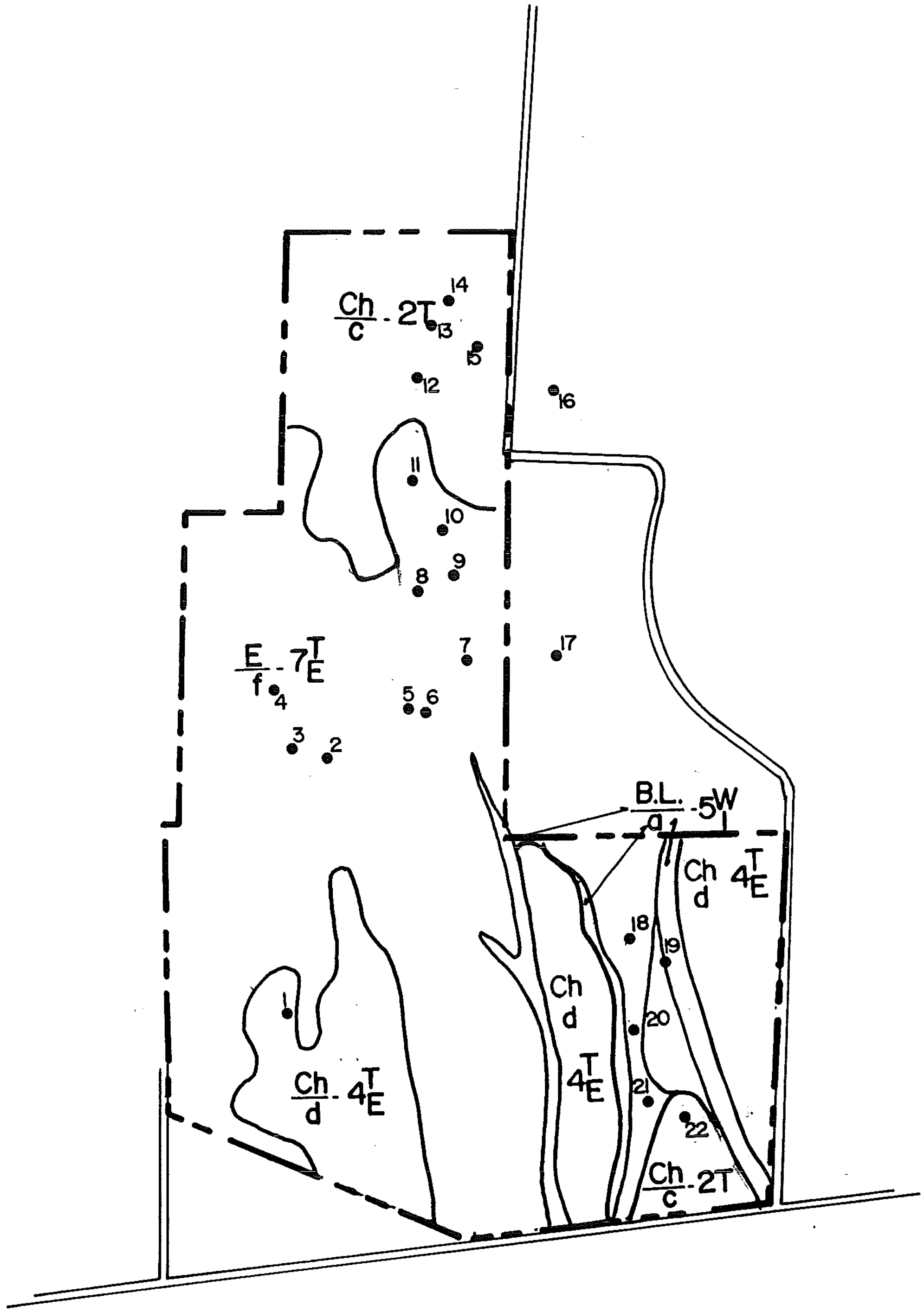
Soils on site F are part of the Oneida catena which is characterized by a clay till to clay loam till parent material. Much of the original soil profile has been removed or disturbed on the site except in areas in the south and north where moderately well-drained soils called the Oneida series predominates. Soil capability is low, approximately 51% of the site is class 7 and the remainder has a breakdown of 6% class 5, 25% class 4 and 18% class 2. Soils are mapped in figure 18 and the map unit convention given in figure 14.

3.4 Conclusions

Site D is in an area of agricultural use where common field crops such as corn, wheat and hay predominate. Some soybeans are presently being grown. The land has a good capability for common field crop production having classes 1 through 3.

Site F is located in an area of mixed land uses where agricultural production is minimal. Ninety percent of the site is in non-agricultural uses and 51% of the land has no agricultural capability. Site F cannot be considered as farm land.

FIGURE 18 SOIL MAP OF SITE F



CONVENTION

soil series name — Ch/c - 2T — capability class

slope class — subclass limitation

•5 borehole location

Approximate scale 1:10,000

Figure 19

Key To Map Crop Symbols

MAP SYMBOL	NAME	DESCRIPTION
F	forage	planted crop of grasses and/or legumes, often referred to as hay
Fg	forage	mainly grasses
Fa	forage	mainly alfalfa
Fc	forage	mainly clover
F/P	forage/pasture	planted crop of forage utilized as pasture later in the year
Smg	small grains	planted fields of wheat, rye, oats and/or barley
Smg-ww	small grains	winter wheat
Smg/Fa	small grains undersown to forage alfalfa	
Be	beans	all crops of beans such as soybeans, kidney beans and black beans
O	orchard	area planted in fruit trees such as apples or pears
Pl	ploughed	a farm field which has been ploughed but not planted at the time of the field survey
C	corn	type of corn (seed, forage or sweet)
P	pasture	farmland on which animals graze
g	grassland	areas with an herbaceous cover without trees or shrubs
W	woodland	an area where the major structural component is trees
Sc	scrubland	interface between woodland and grassland where there are at least two species of woody vegetation and where vegetation does not exceed three metres in height
p	pond	all small bodies of open waters
I	industrial	all areas of light or heavy industry
R	recreation	all areas of public open space such as parks, ball diamonds, hiking trails
B	buildings	all buildings including farm and residential
E	extracted	all areas from which soil and/or rock materials have been removed north
A	abandoned	all areas lying idle and in a state of reversion to natural vegetation

4.0 REHABILITATION TO AGRICULTURAL AFTER USES

4.1 Literature Review

While the rehabilitation of land has a long history, few specific controlled rehabilitation studies with quantitative results are presently available on rehabilitation to an agricultural after-use. In Ontario, no data specific to landfills could be found to quantify or predict the success of rehabilitation to agriculture. The data found is discussed more fully in section 4.3 of this report.

Because of this lack of information, data on rehabilitation was reviewed on a broader basis to include lands disturbed due to right-of-way construction for pipelines and hydro transmission lines, and lands reclaimed after subsurface mining.

The literature was reviewed to ascertain if pre-disturbance agricultural yields could be obtained after rehabilitation.

Some of the literature has already been reviewed in 1980 and 1978 by Ecological Services for Planning for the Region of Halton Landfill Study. This review considers data from throughout the world and is summarized in figure 20. The information contains no yield numbers to indicate that yields matched pre-disturbance levels or were quantitatively comparable to surrounding farmland. Where numbers were available, yields were lower on rehabilitated lands.

Rehabilitation of pits and quarries to agriculture in Ontario has been summarized in two papers. Mackintosh and Mozuraitis (1982) outline a method for rehabilitation to reduce problems associated with former pits or quarries. While the report suggests that rehabilitation is a success, no yield information is included to support the statement. More specific results of the same study (OIP and Univ. of Guelph, 1982) show that the success of the rehabilitation was measured using a capability soil rating system. No yield information was used to rate success.

Figure 20

Summary of ESP Literature Review

Location/disturbance	Year	Author	Comments
Alberta strip mines	1977	McAllister	-good yields where subsoil and topsoil replaced -no comparison to pre-disturbance yields or yields on surrounding properties
N.W. United States on mined lands	1978	Power *et al*	-importance of soil cover stressed -no specific yield data comparisons
Pits & Quarries in S. Ont. (a) Burlington	1977	S.E. Yundt	-pasture produced -no specific data to compare to pre-disturbance yields
(b) Brantford	1975	TCG Materials	-yields of corn less than surrounding farmland (47:80 bu/acre)
(c) Brantford	1977	"	-yields of winter wheat less than surrounding farmland (34:54 bu/acre)
(d) Fontfill	1977 to present	"	-cherry orchards -no data at time of review
Pits & Quarries in Britain	1977	McRae	-outlined requirements for good rehabilitation -some problems with wetter conditions on rehabilitated lands
Landfills in Britain	1973	Webber	-6 sites looked at -yields reported as good or comparable but no numerical data given
Landfill Sites in Waterloo Region	1975-1973	Pihura, Region of Waterloo	-two areas of forage production -no yield data

The second paper (Mackintosh and Hoffman, 1985) surveyed the rehabilitation of former aggregate pits to fruit production. This paper listed problems associated with work and discussed the requirements for rehabilitation success. No data on fruit yields before and after extraction were available.

Some data on yields levels has been obtained before and after the rehabilitation of a pipeline right-of-way. Ecological Services for Planning, Robinson, Merritt and deVries and Smith, Hoffman (1982-1984) show that yield reduction due primarily to soil degradation (compaction, topsoil loss) ranged to 50 %. After subsoiling and the use of green manures yield differences ranged from 20 - 40 %. These yield differences correspond to those measured on Hydro access roads on rights-of-way (up to 40 % in corn after chisel plowing in some cases - Ontario Hydro, 1978).

-52.2 +96.5

Other literature sources discussing the North American experience tend to list the problems associated with landfills and proposed solutions for them (Univ. of Illinois, 1985; K. Sweeney, 1984; Metropolitan Council of Twin Cities Area, 1983; Montague, 1982; Skinner, 1980; G. Noble, 1976; U.S. EPA, 1973).

The best published literature which outlines planned, controlled and monitored work on landfill rehabilitation to agricultural after uses is British. Three major studies on Bush Farm, Papercourt Farm and the Hatfield Quarry (Department of the Environment, 1982a, 1982b; McRae, 1982) are in progress. These studies have looked at site characteristics and modified many management factors to determine which ones most affect yield. A specific code of practice has evolved to cover the following factors:

* kind of machinery for soil pile placement
* soil movement and reinstatement, area of movement
* separation of topsoil and subsoil
* placement, form and erosion control for soil storage piles.
* character of soils imported to the site
* wastes permitted in the landfill
* landfill construction details
* landfill site control
* soil management and cropping program
* weather/climate restrictions
* artificial drainage requirements, methods, timing
* deep cultivation requirements, methods, timing

The aforementioned British literature contains no specific studies on the impacts of landfilling on surrounding farm lands.

4.2 Problems Identified and Mitigation Measures Used

The literature lists a number of problems associated with agricultural production on former landfills. These problems, the solutions tried and their success have been listed in figure 21. The problems are interrelated; thus, some factors such as soil compaction and soil drainage have been artificially divided into separate groups. Solutions to problems common to more than one factor have been discussed only once.

The After - Use Report on site D by Ecological Services for Planning identifies most of the problems found in other rehabilitation schemes. However, their report does not adequately assess the potential impact of methane gas generation and control nor does it address the need for tile drainage.

Figure 21

Landfill Problems and Solutions for Agricultural Use

Problem	Solution	Results & Discussion
Gas production methane ethylene carbon dioxide	-control waste materials type -place gas collection system under impermeable clay cap	-rate and amount of gas generation changed with material type but much gas still in soil profile (Hewitt and McRae, 1986) -where a gas collection system was not in place, poor crop growth areas were found over 20% of the site. (Dept. of Env., 1982b.) -no data available for crop yields where gas collection system has been placed.
Insufficient soil	-import soil -control soil stripping and require conservation of topsoil & subsoil materials	-imported soil was of loam texture to minimize compaction potential. -subsoil and topsoil saved separately and stockpiled in domed piles.
Soil compaction	-control soil reinstatement traffic location & time -control machine type; that is, use machines with low bearing pressure -complete deep Tillage -specify deep Tillage type & machine design -specify cropping program	-data did not show clearly which soil movement system was best (used 2 systems, conventional and bed - bed system requires that machines follow one track) -soil ripping was completed - the authors suggest that better shattering might have occurred if a winged, tined subsoiler was used. -cropping programs included grass or forage production to improve structure and reduce density.
Soil structure	-reduce soil compaction -use legume/forage cropping system -add organic matter to soil	-perennial rye grass used over three seasons to improve soil structure. However there is no specific data on soil structural improvement,
Soil drainage	-dome or slope landfill -improve structure & reduce compaction -install under drainage	-tile drainage was required - used continuous plastic tile instead of clay tile because of differential settlement. -tile was necessary to prevent waterlogging - effectiveness of grass crops was reduced because of excess water.
Soil subsidence	-control waste type -specify waste compaction in layers -re-level area of differential subsidence	-waste materials and different compaction methods were used and subsidence still occurred. -recommended that changes in filling methods and compaction would vary with the nature of the imported fill materials.
Soil fertility	-add organic manures -fertilize	-NPK fertilizers added - no specific indications in the literature whether soil test used to indicate fertility requirements. Experiments recommended to see the effects of different N rates of application. (McRae, 1982)
Crop yield reduction	-attend to soil & gas problems -change seeding rate, spacing, timing -change seed variety or other farm management	-crop yields highly variable from place to place and year to year. -wheat yields on Hatfield quarry higher than natural average but long term average on rehabilited land not known (McRae, 1982).
Weeds	-very vigorous growth usual until healthy crops grown	-weeds successfully treated with herbicides

4.3 Landfill Rehabilitation to Agricultural After Uses in Ontario

Very little information is available to quantitatively measure the success and/or the problems associated with landfill rehabilitation in Ontario. In 1978 - 1980 a questionnaire was prepared by MOE to ascertain where former landfills were located, and to find amongst many factors what their current use, zoning and gas or leachate problems were.

Smith, Hoffman reviewed the records associated with approximately 2500 former landfills. Only 30 areas had "agricultural uses". "Agricultural uses" included in the list were interpreted liberally and included field, open spaces and pasture. Most of the sites are small (size ranges from 0.2 to 20 ha. with a mean size of 2.7 ha - see figure 22). The exact location of some sites was not known. As well, no specific information on crop yields, subsidence or gas generation were available.

Figure 22

LANDFILLS WITH POSSIBLE AGRICULTURAL AFTERUSE

Site Number	Location (Municipality)	Dates Opened	Dates Closed	Area (hectares)	Use	Comments
X5096	Anderdon	1934	1946	0.40	corn field	not sure of exact location
X9028	Winchester	1943	1968	-	farming	
X2033	Zorra	-	-	10.0	Cold Springs Farm	
X2057	Tilbury North	1961	1971	1.0	landscaping site	
X2073	Colborne	1958	1971	3.0	pasture for livestock	
X2096	Holland	1948	1973	0.5	house/farm	
X5011	Ekfrid	-	1954	1.0	A & M Sod Ltd.	
X5027	Ekfrid	1956	1971	1.0	corn field	
X5094	Anderdon	1956	1969	1.0	farmland or open space	exact location unidentifiable
X5089	Mersea	1960	1970	20.0	agricultural	exact location unidentifiable
X5095	Anderdon	1946	1957	-	open space (woodlot) farm field	exact location unidentifiable
X5113	Harwich	-	-	0.2	farm field	
X5111	Highgate	-	1968	0.5	farm fields/ vacant land	
X6028	Mornington	1935	1960	0.6	house/barn	
X6048	Ellice	1962	1968	0.25	agricultural	
X6088	Hullett	1949	1969	0.2	corn field	
X6079	Dawn	1947	1972	0.6	farm field	
X6069	Camden	1935	1955	-	corn field	
X6199	Southwold	1895	1915	0.8	none	inorganic wastes - cars old furniture
X4139	Tiny	-	-	-	field	
X4121	Stayner	1930	1960	0.5	pasture land	
X8075	Cambridge	-	1940	2.0	farm field	
X1356	Field	-	-	0.25	farm field	
X9086	Kitley	1940	1965	1.0	cedars/pasture	
X3068	York North	-	1971	4.85	gardening plots	
X4022	Smith	1954	1957	12.51	pasture land	
X7002	Whitchurch-Stouffville	-	1940	0.55	agricultural	
X7029	Brampton	1944	1950	-	vacant and agricultural	
X7041	Milton	1953	1956	-	agricultural fair barns underneath	
X9023	Carleton West	1961	1971	2.0	agriculture	

A field visit was made with Mr. J. Thomson P. Eng. of the Region of Waterloo to three sites in Waterloo. None of these sites were found as part of the MOE records previously described. The boundaries of two sites were not known. On these small sites, forages were being grown. No bare spots or crop stress were noted on either site, however, no yield data were collected or available. A third larger site has been used for corn production and was in grain at the time of inspection. A number of "bare spots" consistent with gas leakage were observed in the crop. However, no measurements for gases were made.

Therefore, no conclusive evidence on successful landfill rehabilitation in Ontario to agriculture could be found using available data.

4.4 The Proposed Site D Rehabilitation Scheme

The proposed landfill results in the production of a mound on existing agricultural land. While the mound differs from the excavated pits usually used for landfill and described in the rehabilitation literature, the problems of rehabilitation are found irrespective of the final form of the landfill.

The scheme proposed addresses many of the requirements for soil hauling and management, but as has been described previously, does not deal specifically with tile drainage and gas generation. Other specific data on the design and treatment of soil berms and roads is missing. The need for this data is described in the following section.

4.5 Problems with the Proposed Scheme

Problems with the proposed schemes have been divided into groups and have been described under subheadings.

Topsoil

Topsoil depth over the site is highly variable. Depths range from 5 - 32 cm with a mean value of approximately 15 cm. (figure 23). The proposed rehabilitation scheme (ESP, 1986) shows an approximate topsoil depth of 20 centimeters. Some soil will probably need to be

Figure 23

Topsoil Depth

OBSERVATION POINT NO.	DEPTH (cm)	OBSERVATION POINT NO.	DEPTH (cm)
1	5	39	20
2	12	40	17
4	10	41	15
5	15	42	15
6	20	43	25
7	20	44	20
10	20	45	15
11	20	46	20
13	15	47	10
15	15	48	15
17	25	49	25
19	15	50	15
20	20	51	15
22	20	52	22
23	20	53	18
26	25	54	15
27	20	55	20
28	25	56	20
29	25	57	14
30	15	58	18
31	16	59	13
32	20	60	12
33	14	61	13
34	12	62	17
35	20	63	25
36	12	64	27
37	32	65	16
38	12	66	22
		67	20

MEAN - ~~15.21 cm~~ 17.88 cm.

RANGE - 5-32 cm

no data for 10 points

taken from other areas on or off site if the 20 cm. depth specified in the rehabilitation plan is to be maintained.

There will be difficulties in maintaining even the 15 cm mean depth of topsoil that was measured by Smith, Hoffman. The data shows much variability over a small area. That variability includes both changes in drainage class (imperfect to poor drainage) as well as changes in topsoil depth. Careful monitoring by an agricultural specialist with some soils training of a skilled machinery operator will be required to maximize the effective separation of subsoil from topsoil. The separation task will be made more difficult because of the clay content of the soils in combination with wetness. When the poorly drained soils are relatively dry to prevent smearing and compaction, they will tend to form clods which will not conveniently split at the topsoil/subsoil interface. If the soils on site were sands or loams this problem would be reduced.

Cropping Choice

The rehabilitation plan (ESP, 1986) states that two crops should not be grown on the landfill:

* alfalfa -because its deep roots may penetrate the cap.
* soybeans -because these crops do not produce well on rehabilitated lands.

The loss of these two crops reduces the flexibility of the agricultural producer "to meet changing economic conditions and remain flexible". (OMAF Food Land Guidelines, 1978.) This is particularly important when the economic returns for different field crops are reviewed. Figure 24 uses data from OMAF (1982-1987) to show, that for crops grown in the site D area gross margins and returns over cash costs are highest for soybeans and alfalfa hay. Returns are only better for white beans which are not grown extensively in the area. The substitutions of alfalfa hay by red clover will not bring the same economic return; that is, alfalfa hay gets higher prices in the market place (Blair Campbell, personal communication, 1987).

Figure 24

Gross Margins and Returns Over Cash Costs for Crops grown in the Site D Area

	$/acre						$/ha							
	1981		1982		1983		1984		1985		1986		3 Year Average	
Crop	*G	V	G	V	G	V	G	C	G	C	G	C	G	C
Barley	68	73	84	48	82	41	136	74	170	108	181	118	162.3	100.0
Grain Corn	180	120	205	91	199	67	234	171	294	229	325	260	284.3	220.0
Oats							64	2	76	13	86	23	75.3	12.7
Soybeans	108	180	113	159	111	121	351	288	352	289	361	296	354.7	291.0
White Beans	140	141	161	106	144	115	390	324	495	425	385	313	423.3	354.0
Winter Wheat	94	158	106	114	101	95	306	243	252	193	303	228	287.0	221.3
Alfalfa Hay							357	299	348	291	365	302	356.7	297.3
Corn Silage							277	220	335	228	333	275	315.0	241.0

* Where G = gross margin

V = total variable costs

C = returns over cash costs

Data for 1981, 1982 and 1983 have been calculated in a slightly different way and are not entirely comparable with the succeeding years (pers. comm., A. Fisher)

The reduced ability of rehabilitated land to produce a variety of crops also affects the capability class rating of the lands. This is discussed in the following.

Agricultural Capability

The Canada Land Inventory Agricultural Capability System is based on a number of soil and climatic factors (Env. Canada, 1972). As stated in the classification, soils are downgraded when the range of crops is restricted and/or special conservation practices are required. The rehabilitated lands will have a reduced range of crops and require special conservation practices relative to the soils originally on the site. For example, if the soils were originally class 1, then the loss of soybeans and alfalfa would require a downgrading of the soils of at least one class to class two.

Alternatively, the ability of the soils to produce specific yields can be used to measure capability. The After-Use Report produced by ESP (1986) states that yields will reach 90% of average yields in Halton after 5 years of rehabilitation work. This 90% of average was given the following values by Stonehouse (1986) in his report to ESP.

	Grain Corn	Barley	Winter Wheat	Hay
		(tonnes/ha)		
1980	5.27	3.28	2.56	5.58
1981	5.59	3.28	3.03	7.17
1982	4.14	3.28	2.42	6.73
1983	4.58	2.21	2.69	6.95
1984	5.52	3.50	3.70	6.73
5-Year Average	5.02	3.11	2.88	6.63
-90% 5-Year Average	4.52	2.80	2.59	5.97

Source: Ont. Min. Agric. & Food, Publication 20, "Agricultural Statistics for Ontario". Annual.

These average values can then be compared to potential values for each class of land using the research of Hoffman (1973, 1971) and Anderson (1971).

This research compared the yields of different classes of land for common fields crops in Southern Ontario.

	Grain Corn	Barley (tonnes/ha)	Winter Wheat	Hay
Class 1	8.53 ± 0.83	4.36 ± 0.51	No Data	10.57
Class 2	6.58 ± 0.66	3.60 ± 0.37		8.47
Class 3	5.02 ± 0.61	2.80 ± 0.38		6.95
Class 4	3.70 ± 0.51	2.04 ± 0.25		6.14

The comparison of the 90% of 5 year average shows that grain corn yields match those of lands with a capability of class 3.

The same is true of barley and in the case of hay, yields on the rehabilitated land will fall in the range of class 4 land.

Therefore, lands which comprised capability classes 1 through 3 will end up after rehabilitation with yields that are similar to those obtained on capability classes 3 and 4.

The changes in yields anticipated after rehabilitation can be reduced to a single number by use of productivity indices or by use of the yields measured to derive those indices. Using Smith, Hoffman's (SH) and Ecological Services (ESP) figures for all of site D (see figure 15) before and after landfilling indicates the following:

* pre-development productivity indices give a value of 0.82 and 0.80 for ESP and SH respectively.

* post-development productivity indices give a value of 0.53 or 0.45 depending on how much land is actually available for agriculture after rehabilitation.

* expressed in terms of grain corn yield, the existing site has the potential to produce 6.83 - 7.00 tonnes/ha and the rehabilitated site has the potential to produce 3.84 - 4.52 tonnes/ha - post-development yield as a % of pre-development yield is 59 - 65%.

The data used to derive the above is outlined in figure 25.

Figure 25

Productivity Index and Yield Calculations

Using Hoffman's (1973) productivity indices allows for the calculation of class 1 equivalents. This method has been used in many planning studies including those published by Ontario Hydro and the Ontario Waste Management Corporation.

A PRE-DEVELOPMENT

CLASS	AREA (Ha) OF CAPABILITY CLASS (S-H) (a)	AREA AS % OF TOTAL (b)	CLASS 1 EQUIVALENT VALUE (S-H) (c)	AREA (Ha) OF CAPABILITY CLASS (ESP) (d)	AREA AS % OF TOTAL SITE (e)	CLASS 1 EQUIVALENT VALUE (ESP) (f)
1	60.34	47.9 %	0.48	71.2	51	0.51
2	4.57	3.6 %	0.03			
3	56.31	44.7 %	0.29	68.4	49	0.31
4 disturbed or ponds	4.78	3.8 %	0.00			
TOTAL VALUE	126.00		0.80	139.6		0.82

(A value of 1.00 means site is 100% class 1.)

* Calculated as b x productivity index.

B POST-DEVELOPMENT *

CLASS	AREA (Ha) OF CAPABILITY CLASS (S-H) (a)	AREA AS % OF TOTAL (b)	CLASS 1 EQUIVALENT VALUE (S-H) (c)	AREA (Ha) OF CAPABILITY CLASS (ESP) (d)	AREA AS % OF TOTAL SITE (e)	CLASS 1 EQUIVALENT VALUE (ESP) (f)
1						
2						
3	75.2	59.7	0.38	101.8	72.9	0.46
4	2.9	2.3	0.01	4.5	3.2	0.02
5	24.3	19.3	0.06	22.1	15.8	0.05
6						
7	23.6	18.7	0.00	11.1	8	0.0
TOTAL VALUE			0.45			0.53

* assumptions

i) 90% of average yield used as best class attainable.
ii) ESP values taken from hearing data.
iii) S-H data calculated on interpretation of final site contours presented in Design and Operations Report - Site D.
iv) S-H reduced capability class of areas used for roads and buildings.

C YIELD CALCULATIONS

<u>For grain corn</u>

	S-H		ESP	
	tonnes/ha	bu/ac	tonnes/ha	bu/ac
PRE-DEVELOPMENT	6.83	(108.8)	7.00	(111.5)
POST-DEVELOPMENT	3.84	(61.2)	4.52	(72.1)
post-development yield as a % of pre-development yield	59		65	

Economics

The reduced capability of rehabilitated land reduces the opportunity to realize a farm profit. Obviously, this statement must be placed in the context of current trends. Using, OMAF data on cost and returns for cash crop farming (figure 26) demonstrates that when all costs (including fixed costs) are subtracted from returns very few crops are providing returns. This means that profit margins in agriculture are currently diminishing, for those farmers who have higher costs for land and/or machinery. These low returns are supported by data collected by the Halton Federation of Agriculture (1987).

Figure 26

Gross Margins and $ Returns - Selected Field Crops

	COSTS $ PER HECTARE		
	1984	1985	1986
GRAIN CORN			
gross margin	234	294	325
returns over cash costs	171	229	260
gross income - total costs	-174	-101	-65
ALFALFA HAY			
gross margin	357	348	365
returns over cash costs	299	291	302
gross income - total costs	-59	-60	-56
WINTER WHEAT			
gross margins	306	252	303
returns over cash costs	243	193	228
gross income - total costs	-96	-127	-75

see revised Figure 26.

Given that capability class 1 can produce much more than other classes with the same inputs, it means that on class 1 land a farmer has a much better chance of making a profit. This concept has been outlined previously in a document produced by the Centre of Resources Development. (1972)

> "With the 20 percent decrease in productivity between class 1 and 2 land there is some doubt whether farmers can use class 2 to produce the common field crops and still realize a profit. There is little doubt at all that class 4 land cannot be the basis for profitable agriculture when only common field crops are grown. A 50 percent difference between production on class 1 soils and that on class 4 is too great to warrant using class 4 soils for most cultivated crops."

The report also cautions that this relationship only holds when good management and appropriate conservation methods are used by the farmer.

Regardless, it is clear that yields on the rehabilitated land will not be sufficiently high for profit unless other costs are minimized. Therefore, land rental costs must be low to ensure that a farmer will want to work the former landfill site. If gross margins become less over time, then a farmer might have to be paid to induce him or her to cultivate the old landfill site.

The Halton After-Use Report (Landplan, 1986; see Stonehouse) has a section which reports on costs associated with the agricultural rehabilitation. Given the problems possible without the installation of tile drainage, and some yield reductions associated with gas leakage, costs may actually be higher. As well, other costs related to nuisance factors such as bird or rodent damage, machinery damage, or increased machinery operating time around monitoring wells could affect the dollar returns associated with crop production.

Off-Site and Community Impacts

Regardless of the impacts associated with soils and rehabilitation, there will be impacts associated with the Site D Landfill and the surrounding agricultural community during the 20 year time period of the site's operation.

Ecological Services for Planning considered some of these impacts in its analysis (figure 1), but did not consider all of the factors listed by OMAF for major E.A. projects. ESP does state, however, that there will be an impact on the agricultural community surrounding site D (Comparative Analysis Memorandum;

January 23, 1987). Other possible community impacts include contamination of wells and surface water by leachate.

Agricultural access from the home farm to rental land will also be affected. Some of this could be reduced by preventing garbage truck movement on the back roads between the Municipal garbage sources and the landfill.

Miscellaneous Impacts

A number of factors specific to the rehabilitated landfill sites may create problems or nuisance to farm operators. There will be leachate observation wells and there is the possibility of a requirement for gas vents. If present on the lands to be worked for agriculture and while these do not remove a significant amount of land from production, they do present barriers to the movement or use of farm equipment. Farmers must move around vents or observation wells, or lift equipment to cross them. As well, if these materials are constructed of metal or concrete, hitting them (a probability during night operations) may cause damage to farm machinery. This damage together with additional turning of machinery and increased labour time will cost the farmer working site D.

These kind of costs have been recognized and measured by Ontario Hydro and a farmer is compensated for having to move around towers, for example.

Perceived dangers associated with gas leakage is another unknown factor which may affect any desire for rental of the rehabilitated landfill.

4.6 Conclusions

* There is no quantitative data on crop yields for rehabilitated landfills in Ontario.

* English literature shows that rehabilitation requires a specific code of practice (specifications) and that with these, crop yields are often reduced by drainage and escaping gas such as methane.

* Problems of subsidence, gas generation, impeded drainage, crop species restrictions and nuisance will occur on the rehabilitated site.

* A site that had the potential to produce crops will have a significantly reduced potential when rehabilitation is complete. In its present condition the site could produce between 80 - 82% of what the best land, that is, class 1 land, in Ontario could produce. After rehabilitation the land would produce 45 - 53%.

* A number of factors difficult to quantify will affect the agricultural community. These include reduced access for slow moving farm machinery, the perceived dangers associated with leaking gas and the possible down gradient effects of leachate.

5.0 SUMMARY

The results of this report indicate that:

1) Agriculture in Halton Region makes a significant contribution to the local economy;

2) Site D is in an area of active agricultural use;

3) Site D is constituted by Class 1 through 3 agricultural lands, which the Food Land Guidelines identify as lands of agricultural potential which should be preserved;

4) The proposal to landfill on Site D and rehabilitate to an agricultural after-use will result in negative impacts on this agricultural resource:

   a) the rehabilitated site's production potential will be reduced. Post-development yield as a % of a pre-development yield is 59-65%, expressed in terms of grain corn yield. Alternatively, what was 100% class 1 through 3 agricultural land will become predominantly class 3 and 4.

   b) the landfill proposal may create additional negative agricultural impacts, such as:

      * a non-agricultural intrusion in an agricultural community

      * interference with machinery movement and access

      * nuisance such as noise, bird damage, fear of gas explosion, possible contamination of down gradient wells or surface water

In summary, because of both long term (loss of soil capability) and short term impacts (during the life of the landfill) this assessment indicates that, in compliance with the Food Land Guidelines, the proposed landfill should be accommodated, if possible, on lands unsuitable or of lower priority for agriculture.

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7.0 GLOSSARY OF TERMS

The following definitions are taken from the original publication used as a reference for this report.

Census Farm

The 1981 Census defined census farm as an agricultural holding with annual sales of agricultural products of $250.00 or more. In 1971 and 1976 census farm was defined as a 0.4 hectare holding from which $50 in agricultural produce was sold. Previous to that, in 1951 and 1956, a census farm was either 1.2 ha or at least 0.4 ha with sales of $250 in the previous year.

Farm Taxfiler

A farm taxfiler is a taxfiler who reported positive gross income or non-zero net income from incorporated, self-employed farming activity. Both Average Net Farm Income and Average Net Off-Farm Income have been calculated on a "per farm taxfiler" basis.

Rural Farm Population

Rural farm population includes all persons living on census farm holdings located in non-urban areas. Urban population is defined as those persons living in a population concentration of 1,000 or more where the density is 400 or more per square kilometer.

Improved Land

Land other than woodlots which is under crops (field, vegetable, fruit, nursery), in summer fallow, pasture or in uses such as barnyards, laneways, and gardens.

Cash Costs

Costs include total variable costs, interest on the debt portion of investment in tractors and machines, taxes and other overhead costs.

Variable Costs

Variablie costs are those which vary directly with the production of each crop grown. They include seed, plants, hired labour, fertilizers, herbicides, insecticides, fugicides, other materials, machinery operating costs, marketing charges and interest on operating capital.

Fixed Costs

Fixed cost inputs are operator labour, management allowance, interest on land, machinery and buildings, depreciation on machinery and buildings, taxes on real estate (net of farm tax rebate), and other overhead cost items.

In this report, cash costs of production are also determined.

Returns Over Cash Costs

The costs are calculated when gross income is subtracted from cash costs. Costs comprise of all variable costs, as well as interest on the debt portion of tractor and machine investment, real estate taxes and other overhead costs.

Gross Margin

Gross margin is the amount above the variable costs that a crop contributes to the operator for his wages, management, and to the investment in machinery and land.

Agricultural Capability Class

The class, the broadest category in this classification, is a grouping of subclasses that have the same relative degree of limitation or hazard. The limitation or hazard becomes progressively greater from Class 1 to Class 7. The class indicates the general suitability of the soils for agricultural use.

Agricultural Capability Subclass

The subclass is a grouping of soils with similar kinds of limitations and hazards. It provides information on the kind of conservation problem or limitation. The class and subclass together provide the map user with information about the degree and kind of limitation for broad landuse planning, and for the assessment of conservation needs.