4.6. AGRICULTURE

ESG International Inc. (ESG) was contracted by Bennett to conduct an Agricultural Impact Assessment related to the development of the proposed facility. A summary of issues identified in the Approved Terms of Reference is presented here with regards to the existing agricultural environment. The entire report entitled, "Agricultural Impact Assessment" can be found in separate Appendix 10.

The assessment was conducted and prepared in compliance with the Approved Terms of Reference for the Environmental Assessment. The current section describes:

- Bioaccumulation in locally produces animal and plant products,
- Assessment of the value of agriculture in the area- description of agriculture, and estimation of the value of agricultural production, including the sales of businesses dependent on or associated with agriculture,
- Active farm locations, types of crops grown, type of farm operation, farm building and other key permanent facilities,
- Estimation of the level of investment in facilities,
- Secondary and ancillary agricultural uses, and
- Local agricultural employment and income.

A discussion of potential impacts to the agricultural environment can be found in Section 7.6.

4.6.1. Background

This component of the report provides a description of the agricultural resources in the study area. Physical resources, such as soil types and soil capabilities are discussed, as well as investments in agriculture, and current agricultural and non-agricultural land uses throughout the study area. Material for this section was obtained from existing information sources, including government planning documents, as well as agricultural capability and soils mapping. Background information was confirmed and expanded upon through on-site fieldwork, consisting of a land use survey, as well as an agricultural investment determination of the study area.

Located between the Town of Kirkland Lake to the north, and New Liskeard to the south, the Little Clay Belt is a defined area of agriculturally productive soils within surrounding Precambrian rock. Soils in the Little Clay Belt are of varying capability; however, significant portions are of Canada Land Inventory (CLI) classes 2-4. Limited by cool temperatures relative to agricultural areas to the south, class 2 is the highest capability class possible for the soils in this region under the CLI classification system (limitation due to climate is always in effect). The cool climate of the area, and a shorter growing season limits the type of crops that can be produced in the region.

In the 1970's, improved beef markets and improvements in the drainage technology allowed for more productive use of heavy soils, resulting in increased viability of agriculture in the area. Livestock continues to dominate agricultural production, as evidenced by the cropping patterns in the area. Animal feedstuffs including forages, cereal grains, and pasture are the dominant agricultural and use in the area.

Field and background investigations produced mapping that depicts various characteristics of agriculture in the study area, allowing for useful, interpretable information to assess potential impacts.

The land use and agricultural investment survey was used in conjunction with an economic analysis of the value of agriculture in the study area. This included a detailed overview of the agricultural resources of the area, as well as estimates of agricultural employment and income. The methodology relied heavily upon secondary data derived from Statistics Canada's Census of Agriculture and Population Census, as well as knowledge gained from numerous completed and ongoing studies on the economic impacts of agriculture that have recently been conducted throughout a number of counties in Ontario.

4.6.1.1. Physiography

Two general physiographic regions dominate Northern Ontario. The first is underlain by Precambrian rock, and can be covered by varying depths of glacial drift with bedrock commonly at the surface. The second is the lowland plains bordering Hudson Bay and James Bay (Hudson-James Bay Lowlands), with flat boggy terrain underlain by younger sedimentary rocks.

Within the Precambrian shield physiographic region, there are scattered areas where lacustrine clays mixed with sand ridges cover the underlying bedrock with sufficient depth to allow for productive agriculture. These areas include the farming areas of Kenora and Fort Frances, Fort William, Sault Ste. Marie-Sudbury settlements, the Northern Clay belts (Clay Belt of Western Quebec and Northern Ontario), and the Temiskaming (New Liskeard) belt, also known as the Little Clay Belt.

The study area is located within the Little Clay Belt physiographic region. The Little Clay Belt is closely associated with the larger Clay Belt of Western Quebec and Northern Ontario to the north. The two clay belts consist primarily of glaciolacustrine and till deposits separated from each other by surficial Precambrian bedrock surrounding the Town of Kirkland Lake. The belts were formed in the basin of glacial Lake Barlow-Ojibway, the last post-glacial lake to exist in Eastern Canada.

The topography in the Clay Belts is level to slightly undulating with poorly drained depressional low land areas often containing organic deposits consisting of peat, muck, and marl that make drainage of the surrounding heavy clays quite difficult.

Just north of the study area is the Height of Land, with an altitude of 304.8m a.s.l. North of this divide, the surficial drainage is northward towards the Hudson Bay Lowlands, which lie at approximately sea level. South of the divide, including the study area, drainage is southward, with the altitude falling more rapidly than the land north of the divide. Several rivers, flowing in approximately 10 watersheds, are responsible for drainage of the study area. The general direction of flow of these waterways is southeast to Lake Temiskaming. The Blanche River is the largest river in the Study Area. The Blanche and Englehart Rivers drain the majority of the northern and eastern portions of the study area with the Wabi River draining the southern portions. Tributaries of these larger rivers consist of numerous smaller creeks.

4.6.1.2. Soils

The well-drained soils within the study area have developed on sands and gravels deposited by prehistoric glacial meltwater streams and rivers. These lighter souls are found in localized areas amongst the larger lacustrine clay and organic soils.

4.6.1.3. Canada Land Inventory (CLI) Capability within Study Area

The class 2 soils in the study area are located in three primary locations. The first consists of two parallel bands running south-east from Earlton to Lake Temiskaming. These bands compose approximately 12,290 ha, roughly 6.5% of the study area, and make up approximately 22% of the Class 2 soils in the study area. The second is located west of the Town fo Englehart and consists of a large area with inclusions of Class 4 soils contained within it. The third area containing Class 2 soil is located near the western boundary of the Study Area west of the Town of Earlton. This area contains a mixture of soils with varying capabilities including Class 4, Class 5 and organic soils.

The majority of the Class 3 soils in the study area are also present in long bands radiating in a northwesterly direction from Lake Temiskaming and Wabi Bay. The largest area of Class 3 soil is located in the area north of New Liskeard and the northern tip of Wabi Bay. This parcel of Class 3 soils comprises approximately 13,000 ha, nearly one-quarter of the Class 3 soils mapped in the study area. Another band originates on the shores of Lake Temiskaming near the Quebec/Ontario border and runs northwesterly to surround the Town of Englehart. The third, and smallest band originates on the peninsula formation jutting into Lake Temiskaming east of New Liskeard. If you would like to see CLI capability distribution within the study area, please refer to Figure 3-4 of Appendix 10.

Organic soils are found in numerous locations throughout the study area. Organic soils occupy approximately 10% of the study area and are commonly found as small inclusions indicating localized depressional areas.

4.6.1.4. Climate

The study area falls within the boundaries of the Temiskaming climatic region. Temperatures in this region have an annual average of approximately 2.2 degrees Celsius. Winters in this region are quite cold (January average daily temperature is -15 degrees Celsius) and summer temperatures can be quite warm (17 degrees Celsius is average daily temperature for July). The resultant growing season duration is approximately 170 days (Chapman and Thomas, 1968). Many of the class 2 soils within the study area would be considered Class 1 if located in southern Ontario, however, the reduced growing season limits the soils to a class 2 designation.

4.6.2. Bioaccumulation in locally produced animal and plant products

As part of the Terms of Reference, for the agricultural assessment, the performance of a bioaccumulation study was required to determine the potential impact of the routine operation of the proposed thermal

treatment facility on the agricultural products grown in the Kirkland Lake-New Liskeard area. The potential for bioaccumulation of contaminants in the farm food chain was cited as a concern that may ultimately impact the marketability of agricultural products from the area. A screening level assessment of the potential for bioaccumulation of contaminants was therefore performed to evaluate the risk posed to the agricultural economy of the Kirkland Lake – New Liskeard area. This is further discussed in Section 7.6.1.

However, to understand what the calculated bioaccumulation numbers mean, there must be background values to compare with. Benchmark and background concentrations are presented in the section below.

4.6.2.1. Benchmark and Back ground Concentrations

Table 4-24 summarizes the background and benchmark concentrations of contaminants found in available literature. Background contaminant concentrations are estimates of existing concentrations known to be present in food products. Various sources are quoted for these. Mean dietary intakes for various chemical parameters are also given.

Benchmark human ingestion rates of contaminants from food are typically given in mg/kg body weight per day, with the typical adult consumer assumed to weigh 70 kg. Two types of benchmark concentrations are provided: the Oral Reference Dose (ORD) and the Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Level (MRL).

The ORD is a human health benchmark for chronic non-carcinogenic effects developed by the USEPA. The reference dose is defined by the USEPA as an estimate (with uncertainty spanning perhaps an order of magnitude) of daily exposure level (mg/kg body weigh-day) for the human population, including sensitive populations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (USEPA 1998b).

Also provided are Oral Cancer Slope factors (CSFs) for the various contaminants. The Cancer Slope Factor (CSF) developed by the USEPA, and expressed in (mg/kg body weight per day can be used to estimate cancer risk in exposed humans. The CSF is most often derived from studies of laboratory animals, traditionally by application of dose-response models that assume no threshold for carcinogenic effects (i.e., any dose, no matter how small, will result in some risk) and allow for linearity in response at low doses.

Predicted potential increases in contaminant concentrations in meat and milk, as well as the predicted potential increases in the ingestion rates of contaminants found in meat and milk (discussed in Section 7.6.1) were compared to benchmark or background levels to enable a characterization of the potential increase in risk to the farm food chain, and therefore, the potential impact to the agricultural industry in the study area.

Table 4-24 Background and Benchmark Contaminant Concentrations

Parameter	Background Concentration					Oral Reference Dose	ATSDR Oral Minimum Risk Level	Oral Cancer Slope Factor
	Beef (mg/kg)		Milk/Dairy (mg/kg)		Mean Dietary Intake (mg/kg BW/day)	(mg/kg BW/day)*		(mg/kg BW/day)$^{-1}$*
Dioxins & Furans	0.000000220		0.0000000378		0.00000220		0.00000000100 (C)	150000
PCB	0.00751		0.00232		0.0000300	0.0000700	0.0000200 (M)	2.00
Chlorophenol[a]						0.00500		0.0180
Arsenic	0.00780	Raw steak	0.00120	whole milk	0.000671	0.000300	0.000300 (C)	1.50
Beryllium						0.00200		4.30
Cadmium	0.00168	Raw steak	0.000490	whole milk	0.000343	0.00100	0.000200 (C)	15.0
Chromium						0.00300		0.420
Lead	0.0153	Raw steak	0.00230	whole milk	0.000343			0.00850
Mercury					0.000114	0.000300		
Benzo(a)pyrene	0.00260 – 0.0112	broiled meat			0.00000429			7.30
DDT					0.0000400	0.000500	0.000500 (M)	0.340
DDD								0.240
DDE					0.0000150			0.340
Dieldrin					0.00000300	0.0000500	0.0000500 (C)	16.0
Heptachlor					0.000000100	0.000500		4.50
Benzene					0.0000171			0.0290
Bis (2-Chloroethyl) ether								1.10
Chloroform						0.0100	0.0100 (C)	0.00610
Trichloroethylene							0.200 (A)	0.0110

Vinyl Chloride							0.0000200 (C)	1.90
* USEPA (1999)								
[a] Cancer Slope Factor is for Pentachlorophenol								

4.6.3. Assessment of the Value of Agriculture in the Area

This section uses the following methodology to develop the analysis of agriculture in the study area:

- An investigation level land use survey of the study area;
- Review secondary data derived from Statistics Canada's Population Census to define the Study Area;
- Review secondary data derived from Statistics Canada's Census of Agriculture to describe the current and historic agricultural characteristics of the study area, and to compare these to the Northern Ontario Agricultural Region and Ontario. Specifically, the data are used to describe number of farms, farmland and cropland, farm sizes, farm types, labour intensity, and farm operation arrangements;
- Analysis of secondary data derived from Statistics Canada's Census of Agriculture to estimate the value of agriculture in the Study Area, specifically farm gate sales and productivity, farm operating expenditures, net revenue, and farm capital. These statistics are also compared to the Northern Ontario Agricultural Region and Ontario;
- Apply information and techniques derived from previous studies conducted throughout Ontario to estimate the value of Agriculture-related businesses in the Study Area;
- Review of information derived from the Temiskaming Federation of Agriculture to identify current trends and issues facing agriculture in the Study Area; and,
- A case study to examine the potential impact of such a facility on the market perception of agricultural goods produced in the Study Area.

4.6.3.1. Agriculture Trends in the Area

Trends in agriculture within the study area have contrasted those of Southern Ontario and even the rest of Northern Ontario. While Northern Ontario and the province as a whole have seen farmland acreages drop over time, the study area has seen an increase in the amount of land used for farming. Most of this increase has occurred recently, from 1991 to 1996.

Similarly, cropland in the study area has increased while cropland in the rest of Northern Ontario and the province has been in decline. Cropping patterns in the study area are what would be expected considering the large amount of livestock production in the area, with the majority of crops being feedstuff crops, including grains and forages. The climate of the area is not as suitable for the production of cash crops in comparison to more southern regions of Ontario, and subsequently, common cash crops such as corn and soybeans are not as widespread in this area.

Within the remainder of the province the trend is toward fewer farms of larger than average size on a shrinking land base. Within the study area however, farm numbers are increasing, not decreasing, and the

land base is increasing as well. This is in strong contrast to southern Ontario, where average farm size is increasing, while the land base is shrinking as farmland is converted to urban or residential uses.

Most of the available farmland within the study area is under crops, but beef farms are the dominant farm type in the area. Field crop farms (including wheat, grain, oilseed, and other field crops) were the second most numerous farm type, but numbers are below the provincial average, perhaps due to the variation in climate and uneven distribution of suitable areas for field crop agriculture. There are also a number of dairy farms in Armstrong, Casey and Kearns Townships.

4.6.3.2. Value of Agriculture

Levels of investment were estimated by the quantity and quality of agricultural infrastructure on each farm (Appendix A of Appendix 10). According to information obtained during this survey, the Townships of Armstrong (particularly around the Town of Earlton) and Dymond have the greatest amount of investment in agriculture. There are numerous farm operations with a high level of investment, as well as several agricultural businesses that also represent a significant investment in agriculture in the area.

Agricultural investment in Casey Township is focused in the southeastern portion of the Township along the provincial boundary due east of Casey Mountain. Several high-investment farms as well as several moderate-investment farms and an agricultural business make up this agricultural "hot-spot."

Despite the increase of 42 farms (7.7%) in the study area between 1991 and 1996, the number of on-farm jobs declined by 121 jobs (-13.1%). This is a much higher rate than the decline of agricultural jobs in Ontario (-6.3%) over the same period, and may be an indication of the effects of increasing capital investment in study area farms.

On average, there were fewer jobs per farm in the study area than there were in Ontario in 1996 (1.4 jobs per farm in the study area versus 1.9 jobs per farm in Ontario). Armstrong Township, which had the highest concentration of Dairy farms, also had the highest number of jobs per farm (3.2). Farms in four townships averaged less than one job per farm: Brethour and Hudson (0.7 jobs per farm) and Dack and Harley (0.8 jobs per farm).

As farms were larger in the study area than in Ontario, the average number of acres per job was also higher in the study area (264 acres per job in the study area vs. 106 acres per job in Ontario). This means that the average farm in the study area required at least 264 acres in order to provide one full-time on-farm job. This number varied across the study area according to township and the composition of the agricultural community within: from 151 acres per job in Armstrong Township to 663 acres per job in Brethour Township.

4.6.3.3. Farm Operation Arrangements

Most of the farms in the study area (57.9%) were operated by a Sole Proprietor (one-person operations) in 1996. This is similar to the average for Ontario (57.0%), but much higher than in Northern Ontario (42.8%). In Northern Ontario, the greatest number of farms were operated as Partnerships (43.8%). Partnerships (farms operating with and without written agreements between partners) were the second most common operation arrangement in the Study Area and in Ontario (33.8% and 31.2%, respectively).

Smaller proportions of farms were operated as either Corporations (Family and Non-family farms) or Other (other types of operating arrangements that are not otherwise categorized) arrangements.

4.6.3.4. Value of Agriculture-related Businesses

Recently there has been a great deal of research conducted on estimating the value of agriculture-related businesses[1]. The overall objective of this research is to estimate the total economic impact of agriculture on the economy of the Study Area in terms of total sales and jobs generated both on and off-farm. The research has been conducted in some of the largest agriculture-producing counties in Ontario (i.e. Huron, Middlesex, Perth and Oxford Counties), as well as some counties where agriculture makes a smaller economic contribution than other industries in the county (i.e. Lambton and Ottawa-Carlton).

Aside from estimating the *direct* impacts of agriculture in terms of the total on-farm jobs and direct farm gate sales produced, the research examines the *indirect* and *induced* relationships between agriculture and businesses with a variety of relationships to the farm. Indirect impacts are measured through the total number of sales and jobs in businesses that deal directly with the farm as a business through the sales and purchases of products and services (e.g. equipment dealers, transport providers, construction companies and professional services) or businesses that deal indirectly with the farm as a business but are in some way related to agriculture (e.g. food processing plants, produce wholesalers and grocery store chains). Induced impacts measure the total jobs in the service sectors, which provide products and services for farmers and their families (e.g. education, government, health and social services).

On average, the research calculates a sales multiplier of 2.83 results from farm gate sales across the province. This indicates that for every $1 in farm gate sales generated, an additional $1.83 in sales related to agriculture is also produced. This number includes the larger agricultural counties in Southern Ontario. The study in Lanark and Renfrew Counties which is most similar to the study area in terms of agricultural production and composition ($98.0 million in farm gate sales in 1995 for the two counties combined) produced a sales multiplier of 2.45, or an additional $1.45 for every $1 in farm gate sales. When these two sales multipliers are applied to the $35,399,900 in direct 1995 farm gate sales in the study area, it provides an estimated range of between $51.3 million to $64.8 million dollars in indirect agricultural sales. When added to the total farm gate sales, this provides an estimate of the total value of agriculture-related sales in the Study Area of between $86.7 million to $100.2 million annually.

The research has also applied this principle to jobs in agriculture. On average, the employment multiplier has been calculated at 2.76 (1.76 additional jobs supported by every job on the farm). The Lanark and Renfrew study calculated an employment multiplier of 2.33, or an additional 1.33 jobs generated off-farm for every job on the farm. When these two employment multipliers are applied to the 795 in direct 1996 on-farm jobs, it provides an estimated range of between 1,057 and 1,399 jobs in indirect and induced jobs supported by agriculture in the study area. When added to the total on-farm jobs, this would provide an estimate of the total number of jobs related to agriculture in the study area of between 1,852 and 2,194 jobs annually.

[1] Studies using comparable methodologies were conducted from 1998 to 2000 in: Lambton, Elgin, Middlesex, Oxford, Huron, Perth and Simcoe Counties; Frontenac, Lennox & Addington, Leeds and Grenville Counties; Lanark & Renfrew Counties, Prescott, Russell, Stormont, Dundas and Glengarry Counties and the Regional Municipality of Ottawa-Carlton.

4.6.3.5. Summary of the Value Agriculture within the Study Area

The analysis shows that agriculture is a vibrant and growing industry in the study area. The study area is one of the most important agricultural regions in Northern Ontario, comprising more than 20% of Northern Ontario's farms and farmland. Between 1986 and 1996 (the year for which the most recent Census of Agriculture data are available), both the number of farms and the area of farmland in the study area increased, while both were decreasing across Ontario. This increase of farmland in the Study Area was largely attributable to the expansion of cropland, which increased by 13.0% in the study area between 1991 and 1996. Farms in the Study Area are generally larger then the average Ontario farm. Beef farms are the dominant farm type in the study area, followed by Field Crop farms and Dairy farms.

Farm gate sales in the study Area also continue to increase, and on-farm production is becoming more capital-intensive. These are also trends recognized across the province. Average farm gate sales per farm in the study area are higher than those in Northern Ontario, but substantially lower than those for the province as a whole. As a result, average income per farm and per acre of farmland in the study area are also lower than those across Ontario. The number of on-farm jobs in the study area, however, continues to decline at levels higher than those across the province. Fewer on-farm workers are being drawn to farms from urban areas.

4.6.4. Active farm locations, types of crops grown, type of farm operation, farm buildings and other key permanent facilities

Efforts have been made to provide information on twenty-year historical trends for the study area as a whole, with more detailed ten-year trends at the township level. Comparisons have also been made to the Northern Ontario Agricultural Region as well as the province of Ontario. OMAF defines "Northern Ontario" as being comprised of ten territorial districts - Algoma, Cochrane, Kenora, Manitoulin, Nippissing, Parry Sound, Rainy River, Sudbury, Thunder Bay and Timiskaming, and the District Municipality of Muskoka.

For the purpose of this report, the Northern Agricultural Region will include Algoma District, Cochrane District, Kenora District, Manitoulin District, Nippissing District, Rainy River District, Sudbury District, Sudbury Regional Municipality, Thunder Bay District and Temiskaming District. This allows for a better understanding of the role of agriculture within the study area, as well as its contribution to regional and provincial economies.

4.6.4.1. Number of Farms

Table 4-25 shows the number of farms in the study area, Northern Ontario and Ontario for the period 1976 to 1996. Over this time the number of farms in the study area has risen by 35 farms (6.3%). This is in contrast with trends in both Northern Ontario (-21.6% from 1981 to 1996) and Ontario (-12.3% from 1976 to 1996), which indicate that the number of farms is in decline. However, the 589 farms found in the study area in 1996 accounted for less than one percent of all farms in Ontario.

Table 4-25 Number of Farms in the Study Area, Northern Ontario and Ontario, 1976-1996

	1976	1981	1986	1991	1996
Study Area	554	663	571	547	589
Northern Ontario	N/A	3,715	3,152	2,908	2,915
% Northern Ontario in S.A.	N/A	17.8%	18.1%	18.8%	20.2%
Ontario	76,983	82,448	72,713	68,633	67,520

Table 3-5 (Appendix 10) provides data on the number of farms and changes in the number of farms at the township level, for the periods 1986 to 1991 and 1991 to 1996. With the exception of Evanturel and Harley Townships, all townships in the study area either showed no increase in the number of farms or lost farms between 1986 and 1991. The number of farms in Evanturel increased by 17 (113%). Temiskaming Unorganized, West Part had the greatest number of farms, but also covers numerous townships. In terms of individual townships, Kearns had the greatest number of farms (65) in 1986 and 1991 (61). Dymond also had 65 farms in 1986, but this data includes farms from Haileybury.

All townships in the study area, with the exception of Kearns Township, showed increases in the number of farms between 1991 and 1996. However, Kearns still had the greatest number of farms of any individual township in 1996. Dymond includes data from Dymond Township and Haileybury; and Dack includes data from Dack and Chamberlain Townships. High numbers of farms were also found in Temiskaming Unorganized, West Part and Dymond.

4.6.4.2. Farmland and Cropland

Crop cover patterns were mapped during the land use survey (Appendix 10, Figure 3.6). Cropping patterns observed in the study area are what would be expected, considering the large amount of livestock production in the area. The majority of crops were feedstuff crops such as grains and forages. The climate of the area is not as suitable as more southern regions of Ontario for the production of cash crops, and subsequently the most common cash crops, such as corn and soybeans, are not as widespread in this area. Definitions of crop types are provided in Appendix A of Appendix 10.

Appendix 10, Figure 3.6 shows that the vast majority (51%) of the land under agricultural cultivation is currently being used for forage production. Grain production is the second most widespread agricultural activity in the Study Area (37% of cultivated area). Small areas of row crop production are scattered through the midsection of the study area. The area with the greatest row crop production is located directly south of Earlton. Row crops occupy only 1,073 ha (1.8%) of the cultivated land in the study area.

Appendix 10 Table 3-6, shows the area of farmland in the Study Area, Northern Ontario and Ontario for the 1976 to 1996 period. Over this time the total area of farmland in the province has decreased by 864,759 acres (-5.9%). Much of this loss comes as a result of the conversion of farmland to urban development in southern Ontario. However, the area of farmland in Northern Ontario has shown even more drastic decline, having decreased by 191,791 acres between 1981 and 1996 (-15.8%). The amount of farmland in the study area, however, increased by 4,114 acres (2.0%) between 1976 and 1996. This number seems appropriate given the changes in the number of farms in the study area as discussed above.

Appendix 10 Table 3-9, shows that, within the study area, the area of cropland increased by 13.0% between 1991 and 1996 (unfortunately, 1986 area in cropland data are not directly comparable to other census years at the Census Consolidated Subdivision level). Most townships showed high rates of increase in area of cropland, including 50.4% in Evanturel, 39.8% in Hilliard, 35.3% in Harris and 30.9% in Hudson. Only three townships recorded a decrease in the area of cropland between 1991 and 1996: Brethour (-1.0%), Dymond (9.3%) and Harley (3.5%). As of 1996, Armstrong Township had the greatest area of cropland of any one township (15,371 acres), while Brethour had the least (4,120 acres).

The importance of crops in local agriculture is shown in Table 4-26. Land under crops was the dominant use of farmland in the study area, accounting for 106,421 acres, or 50.7% of all farmland in the study area in 1996. Other uses, was the second largest use of farmland (47,882 acres, or 22.8% of farmland), followed by Unimproved Pasture (37,519 acres, or 17.9%) and Improved Pasture (17,660 acres, or 8.4%). Very little farmland was used for Summer Fallow; only 551 acres (0.3% of total farmland) was recorded in the study area in 1996.

Table 4-26 Land Area Classified by Use in the Study Area, 1996 (in acres)

	Under Crops	Summer Fallow	Improved Pasture	Unimproved Pasture	Other[2]
Armstrong	15,371	0	1,886	2,100	2,469
Brethour	4,120	0	422	3,081	2,325
Casey	9,248	N/A	1,056	1,746	N/A
Dack	▪ 7,583	36	1,763	5,787	6,962
Dymond	9,026	N/A	2,613	2,647	N/A
Evanturel	7,149	N/A	1,113	2,015	N/A
Harley	4,384	0	552	1,521	2,500
Harris	4,534	N/A	448	2,467	N/A
Hilliard	8,175	N/A	796	1,459	N/A
Hudson	4,321	N/A	1,352	1,735	N/A
Kerns	12,512	N/A	1,979	2,810	N/A
Temiskaming Unorganized West part	19,998	272	3,680	10,151	16,090
Total	106,421	551	17,660	37,519	47,882

Farms in the study area are large. Appendix 10, Table 3-11 shows that, on average, farms in the study area in 1996 were 357 acres in size; 151 acres (73.3%) larger than farms in Ontario and 5 acres (1.4%) larger than farms in the Northern Ontario region. Farms throughout most of the townships in the study area were actually smaller in size than they were in 1986, which again contradicts trends in Northern Ontario and Ontario. In 1996, the largest farms in the study area were found in Armstrong and Brethour (average 474 acres each), and Hilliard (423 acres). Harley recorded the smallest average farms (230 acres) although these were still larger than the provincial average. Appendix 10, Table 3-12 compares the

[2] The Other land use classification includes area covered by Christmas trees. In 1996, four Christmas tree farms were recorded in the Study Area (3 in Haileybury and 1 in Temiskaming Unorganized, West Part). The total area of land occupied by these farms was 146 acres.

percentage of farms, small (0-179 acres), medium (180-759 acres) and large (760+ acres) in the study area, Northern Ontario and Ontario, for 1986, 1991 and 1996.

4.6.4.3. Type of Farm

During the land use survey of the Study Area, farm types were recorded based on reconnaissance observations of livestock presence or absence, type of livestock, and type of farm infrastructure. Farms identified within the study area are primarily livestock operations, including beef, dairy, sheep, horse, and general livestock. Cash crop and abandoned or retired operations were also identified. Appendix 10, Figure 3.7 shows the farm types and their distribution throughout the study area.

Farms in the study area are diverse in terms of their products. Appendix 10, Table 3-13 identifies the types of farms in the study area which had sales of $2,500 or more, based on farming activity which accounts for at least 50 percent of total farm income, in 1996. Although data have shown that most of the available farmland in the Study Area was under crops, Beef Farms were the dominant farm type in the area. The Statistical data confirms our observations of farm type as shown in Appendix 10, Figure 3.7. The Northern Ontario region and the study area specialize in beef farms; 34.8% of farms in Northern Ontario and 29.3% of farms in the study area were devoted to this activity, compared to only 23.7% of farms across Ontario (Appendix 10, Figure 3.8, Appendix A). Beef farms were well-distributed throughout the study area, with the greatest number of farms being found in Temiskaming Unorganized, West Part. Dack had the greatest number of beef farms of any individual township.

Field Crop farms, which include wheat, grain, oilseed and other field crops, were the second most-numerous farm type, and were similarly scattered throughout the study area. However, Field Crop farms were under-represented in both the study area (27.5% of all farms) and the Northern Ontario region (21.6% of all farms) compared to Ontario as a whole (29.5% of all farms). This is likely due to the variety of climates and uneven distribution of Crop Heat Units throughout the province.

The dairy industry also had good representation in the study area, with high concentrations of Dairy farms in Armstrong, Casey and Kerns townships. The study area was specialized in Dairy farms (19.5% of farms) when compared to Northern Ontario (15.2% of farms) and Ontario (13.9% of farms).

4.6.5. Estimation of the level of investment in facilities

During the land use survey levels of investment were estimated based on the quantity and quality of agricultural infrastructure on each farm. Farms with high levels of investment and agricultural businesses were given a “3” rating, while farms with moderate and low levels of investment were given a “2” and “1” rating, respectively. Abandoned and remnant farms were assigned a rating of “0” indicating no investment in agricultural infrastructure. Agricultural businesses were considered to have a high level of investment. Further explanation of the farm investment ratings is included in Appendix A of Appendix 10.

Appendix 10, Figure 3.5 shows the varying levels of agricultural investment throughout the study area. The coloured circles represent individual farm operations, and the coloured shading represents investment zones determined by the investment levels of the farms in the area.

According to information obtained during this survey, the Townships of Armstrong and Dymond seem to have the greatest amount of investment in agriculture, and there are numerous "hot spots" of investment located throughout the study area (Appendix A of Appendix 10).

Central Armstrong Township, around the Town of Earlton, seems to have a large amount of agricultural investment. There are numerous farm operations with a high level of investment, as well as several agricultural businesses that also represent a significant investment in agriculture in the area.

Another area of increased agricultural investment is the eastern portion of the Township of Dymond. To the east of Highway 11 and the Dymond/Harris Township boundary, there are numerous farms located along the north-south oriented roads. A large portion of these farms possess high or moderate levels of investment. Two agriculture-related businesses are also located in this area.

Agricultural investment in Casey Township is focused in the southeastern portion of the Township along the provincial boundary due east of Casey Mountain. Several high-investment farms, as well as several moderate-investment farms and an agricultural business make up this agricultural "hot-spot."

4.6.5.1. Farm Gate Sales and Farm Productivity

Sales in the three regions continue to grow; between 1990 and 1995 farm gate sales in Ontario increased by $1.1 billion (16.5%), while sales in the Northern Ontario region over this period increased by $13.2 million (9.5%). Farm gate sales in the study area increased by almost $5.8 million (18.9%). The study area provides a valuable contribution to Northern Ontario's agricultural economy, yielding between 22.1% and 24.0% of the region's, and between 0.4% and 0.5% of Ontario's total farm gate sales annually. This provides a good indication that agriculture in the study area is growing at a rate comparable to that of larger, more intensive agricultural counties in Southern Ontario.

Although farm gate sales increased in the study area between each of the most recent census periods, this growth has not been evenly distributed among the townships. Brethour, Dack, Harley and Harris Townships recorded a decline in farm gate sales between 1990 and 1995. High sales figures and strong growth in sales have been demonstrated in Armstrong, Casey, Dymond, Evanturel, Hilliard and Kerns Townships, as well as Temiskaming Unorganized, West Part. Armstrong typically produces the highest farm gate sales in the study area, while Harris produces the lowest.

On average, farms in the study area produced $61,799 in farm gate sales. This was $9,728 (18.7%) higher than the average farm gate sales per farm in Northern Ontario ($52,071), but $53,409 (46.4%) less than the average farm gate sales per farm in Ontario ($115,203). On a per acre basis, farms in the study area produced average sales of $173/acre. This was $25 (16.9%) higher than Northern Ontario ($148/acre), but $387 (69.1%) lower than the average sales per acre in Ontario ($560).

These figures vary throughout the townships in the study area. Average sales per farm range from $23,007 in Harley Township (400.1% lower than Ontario's average) to $177,370 in Armstrong Township (54.0% higher than Ontario's average). Armstrong is the only township in the study area with average sales per farm that were higher than the provincial average. Average farm gate sales per acre in the study area ranged from $96/acre in Temiskaming Unorganized, West Part to $374/acre in Armstrong Township.

4.6.5.2. Farm Operating Expenditures

Expenditures also continue to increase; between 1990 and 1995 expenditures increased in Ontario by $1.08 billion (19.8%), in northern Ontario by $17.5 million (15.1%) and in the study area by $5.1 million (19.2%). These figures are important to note as they indicate that the rate of growth in expenditures exceeded the rate of growth in farm gate sales in each of the three regions.

On average, farms in the study area had $53,461 in operating expenses. This was $7,578 (16.5%) higher than the average operating expense per farm in Northern Ontario ($45,883), but $43,481 (44.9%) less than the average operating expenses per farm in Ontario ($96,942). On a per acre basis, farms in the study area had average expenses of $150/acre. This was $20 (15.4%) higher than Northern Ontario ($130/acre), but $322 (68.2%) lower than the average expenditures per acre in Ontario ($472/acre).

These figures range throughout the townships in the study area. Average operating expenditures per farm range from $25,256 in Harley Township (26.1% lower than Ontario's average) to $126,987 in Armstrong Township (31.0% higher than Ontario's average). Armstrong was the only township in the study area with average expenditures per farm that were higher than the provincial average. Average operating expenditures per acre in the study area ranged from $88/acre in Brethour Township to $268/acre in Armstrong Township.

4.6.5.3. Net Revenue

Net revenue has been calculated by subtracting total operating expenditures from total farm gate sales. In conjunction with farm gate sales and operating expenditures, net revenue of farms in the study area continues to increase over the long term, although total net revenue in the Northern Ontario region experienced decline by almost 19.4% (-$4.4 million) between 1990 and 1995. This decline is due primarily to the high rate of growth in operating expenditures in the region during this time. Net revenue in the study area during the 1990 to 1995 period increased by 16.7% ($704,406), which is substantially higher than both the Northern Ontario region and the 1.9% increase in net revenue in Ontario ($24.1 million).

On average, farms in the study area had $8,338 in net revenue. This was $2,150 (34.7%) higher than the average net revenue per farm in Northern Ontario ($6,188), but $9,923 (54.3%) less than the average net revenue per farm in Ontario ($18,261). On a per acre basis, farms in the study area had an average net revenue of $23/acre. This was $5 (27.8%) higher than Northern Ontario ($18/acre), but $66 (74.2%) lower than the average net revenue per acre in Ontario ($89/acre).

Net revenue is not distributed evenly across the townships; many townships exhibit declining net revenue. Brethour, Dack, Harley and Harris Townships exhibited negative net revenues in 1995, indicating that many farms in these townships operated at a loss in that year and were rendered vulnerable. Armstrong, Casey, Evanturel and Hilliard Townships had the highest net revenues in the study area in 1995.

Average net revenue per farm ranges from -$4,310 in Harris Township to $50,383 in Armstrong Township. Armstrong, Casey, Evanturel and Hilliard Townships all had average net revenues per farm that were higher than the provincial average. Average net revenue per acre in the study area ranged from -$13 in Harris Township to $106 in Armstrong Township (19.1% higher than Ontario's average).

Armstrong was the only township in the study area with average net revenue per acre that was higher than the provincial average.

4.6.5.4. Farm Capital

Investment in farm capital is a critical component to the economic viability of Ontario's farms. As farms become larger and the on-farm labour force decreases, the agriculture industry has become more capital intensive. Farm capital in the study area increased to an all-time high of over $219 million in 1996, an increase of almost 35.8% ($57.8 million) since 1991. This rate of investment is much higher than the rates in either Northern Ontario (23.8%) or Ontario (0.4%) over the same period.

Unlike farm gate sales, operating expenditures and net revenue, the rate of investment in farm capital has increased in all townships (with the exception of Harris Township in 1991 to 1996). This is a further indication of the level of vulnerability of farms in the townships, which demonstrated low and negative net revenues; on average these farms are investing more but receiving less for their efforts.

On average, farms in the study area had $372,419 in farm capital. This was $21,562 (6.1%) higher than the average farm capital per farm in Northern Ontario ($350,857), but $232,749 (38.5%) less than the average net farm capital per farm in Ontario ($605,168). On a per acre basis, farms in the study area had average farm capital of $1,044/acre. This was $46 (4.6%) higher than Northern Ontario ($998/acre), but $1,900 (64.5%) lower than the average farm capital per acre in Ontario ($2,944/acre).

These figures range throughout the townships in the study area. Average farm capital per farm ranges from to $238,111 in Harley Township to $607,238 in Armstrong Township. Armstrong was the only township in the study area with average farm capital per farm that was higher than the provincial average. Average farm capital per acre in the study area ranged from $538/acre in Brethour Township to $1,280/acre in Armstrong Township.

4.6.6. Secondary and ancillary agricultural uses; and Local agricultural employment and income

Appendix 10, Table 3-14, provides employment data in the agricultural sector for the study area and Ontario for 1991 and 1996. The data show that on-farm jobs in both the study area and Ontario declined during the five-year period.

Despite the increase of 42 farms (7.7%) in the study area between 1991 and 1996, the number of on-farm jobs declined by 121 jobs (-13.1%). This is a much higher rate than the decline of agricultural jobs in Ontario (-6.3%) over the same period, and may be an indication of the effects of increasing capital investment in study area farms.

In terms of real jobs in 1996, Armstrong Township had the greatest number of on-farm jobs (145), followed by Temiskaming Unorganized, West Part (135). Urban areas, such as Kirkland Lake, Englehart and Thornloe were important sources of on-farm labour in 1991 and 1996, although this component decreased by 55 jobs (-44.0%). In terms of growth, Evanturel Township recorded the highest percentage growth in agricultural jobs, adding 25 jobs (125%) between 1991 and 1996. This was followed by Armstrong Township (60 jobs, or 70.6%). Hudson Township had the greatest rate of decline (-50.0%).

Intensity of on-farm labour varied widely across the study area. Appendix 10, Table 3-15 shows the average number of jobs per farm and acres per job.

On average, there were fewer jobs per farm in the study area than there were in Ontario in 1996 (1.4 jobs per farm in the study area versus 1.9 jobs per farm in Ontario). Armstrong Township, which had the highest concentration of Dairy farms, also had the highest number of jobs per farm (3.2). Farms in four townships averaged less than one job per farm. These townships are Brethour and Hudson (0.7 jobs per farm) and Dack and Harley (0.8 jobs per farm).

As average farm size is larger in the study area compared to the Ontario average, the average number of acres per job was also higher in the study area (264 acres per job in the study area vs. 106 acres per job is Ontario). In simpler terminology, this means that the average farm in the study area required at least 264 acres in size in order to provide one full-time on-farm job. This number varied across the study area according to township and the composition of the agricultural community within; from 151 acres per job in Armstrong Township to 663 acres per job in Brethour Township.

4.6.6.1. Value of Agriculture-Related Businesses

Recently there has been a great deal of research conducted on estimating the value of agriculture-related businesses[3]. The overall objective of this research is to estimate the total economic impact of agriculture on the economy of the study area in terms of total sales and jobs generated both on and off-farm. The research has been conducted in some of the largest agriculture-producing counties in Ontario (i.e. Huron, Middlesex, Perth and Oxford Counties), as well as some counties where agriculture makes a smaller economic contribution than other industries in the county (i.e. Lambton and Ottawa-Carlton).

Aside from estimating the direct impacts of agriculture in terms of the total on-farm jobs and direct farm gate sales produced, the research examines the indirect and induced relationships between agriculture and businesses with a variety of relationships to the farm. Indirect impacts are measured through the total number of sales and jobs in businesses that deal directly with the farm as a business through the sales and purchases of products and services (e.g. equipment dealers, transport providers, construction companies and professional services) or businesses that deal indirectly with the farm as a business but are in some way related to agriculture (e.g. food processing plants, produce wholesalers and grocery store chains). Induced impacts measure the total jobs in the service sectors, which provide products and services for farmers and their families (e.g. education, government, health and social services).

On average, the research calculates a sales multiplier of 2.83 results from farm gate sales across the province. This indicates that for every $1 in farm gate sales generated, an additional $1.83 in sales related to agriculture is also produced. This number includes the larger agricultural counties in Southern Ontario. The study in Lanark and Renfrew Counties (Cummings et al., 2000), which is most similar to the study area in terms of agricultural production and composition ($98.0 million in farm gate sales in 1995 for the two counties combined) produced a sales multiplier of 2.45, or an additional $1.45 for every $1 in farm gate sales. When these two sales multipliers are applied to the $35,399,900 in direct 1995 farm gate sales in the study area, it provides an estimated range of between $51.3 million to $64.8 million dollars in

[3] Studies using comparable methodologies were conducted from 1998 to 2000 in: Lambton, Elgin, Middlesex, Oxford, Huron, Perth and Simcoe Counties; Frontenac, Lennox & Addington, Leeds and Grenville Counties; Lanark & Renfrew Counties, Prescott, Russell, Stormont, Dundas and Glengarry Counties and the Regional Municipality of Ottawa-Carlton.

indirect agricultural sales. When added to the total farm gate sales, this provides an estimate of the total value of agriculture-related sales in the study area of between $86.7 million to $100.2 million annually.

The research has also applied this principle to jobs in agriculture. On average, the employment multiplier has been calculated at 2.76 (1.76 additional jobs supported by every job on the farm). The Lanark and Renfrew study calculated an employment multiplier of 2.33, or an additional 1.33 jobs generated off-farm for every job on the farm. When these two employment multipliers are applied to the 795 in direct 1996 on-farm jobs, it provides an estimated range of between 1,057 and 1,399 jobs in indirect and induced jobs supported by agriculture in the study area. When added to the total on-farm jobs, this would provide an estimate of the total number of jobs related to agriculture in the study area of between 1,852 and 2,194 jobs annually.

4.6.7. Conclusion

The study area is situated in an area known as the Little Clay Belt, an area known for its good agricultural soil. Approximately 58% of the study area consists of CLI classes 2-3, a proportion significantly higher than I n the surrounding area. The climate of the area restricts the growing season to approximately 170 days and limits the range of crops grown. The predominant crops include forages and grain crops with some row crops such as corn and soybeans. Cash crops, beef and dairy operations are the dominant farm types in the region. The intensity and investment in agriculture varies throughout the study area, with the most intense agricultural operations found between Englehart and New Liskeard.

Agriculture contributes significantly to the overall economy of Northern Ontario and the study area. It comprises more than 20% of northern Ontario's farms and farmland. A review of the agricultural statistics indicates that agriculture is expanding within the study area, in terms of capital assets, land base and production. Contrary to the province-wide trend of decreasing numbers of farms and availability of farmland, the number of farms and area of farmland in the study area is increasing. It is expected that agriculture in the study area will continue to be viable and contribute significantly to the economy of Northern Ontario.

As demonstrated above the Agricultural Impact Assessment was completed pursuant to the approved Terms of Reference describing: the bioaccumulation in locally produced animal and plant products; an assessment of the value of agriculture in the area; active farm locations, types of crops grown, the type of farm operation, farm building and other key permanent features; an estimation of the level of investment in facilities; and the secondary and ancillary uses. For the further detail on agricultural impacts please see Appendix 10, Agricultural Impact Assessment. A discussion of potential effects to the agricultural environment can be found in Section 7.6.