

407 East Individual Environmental Assessment (IEA) and Preliminary Design Study

Agriculture Existing Conditions Technical Report

August 2009

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1. Introduction

This report provides an overview of the existing agricultural conditions associated with the 407 East Environmental Assessment (EA) analysis area as defined in the EA Terms of Reference. A series of overviews are proposed to identify existing and future social, economic, cultural and natural environment conditions within the EA analysis area for use in generating constraints mapping, assessing alternatives to the undertaking, and refining the EA analysis area. In total, nine overviews are proposed:

1. Socio-Economic (Provincial policy/Official Plan, industrial/commercial/residential, economic base/trade corridors, tourism, and community and recreation)
2. Agriculture
3. Natural Environment (vegetation, wildlife, fish and aquatic habitat, and hydrogeology)
4. Drainage
5. Cultural Heritage
6. Archaeology
7. Air
8. Noise
9. Waste

The results from undertaking each of these overviews will be documented in a stand-alone technical report during the EA. In each case, a draft will be prepared and circulated for comment. Upon finalization, the contents will be summarized along with the other technical reports under one cover as an “Existing and Future Conditions Report” and made available for agencies/public review. The final Existing Conditions Report will form a chapter of the EA Report with each of the stand-alone technical reports becoming appendices to the EA Report.

1.1 Soils Study Team

The Agriculture study team consisted of DBH Soils Services Inc. staff. The actual individuals and their specific roles are provided as follows:

- Dave Hodgson - President

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2. 407 East Analysis Area

As part of the approved ToR, an initial 407 East EA analysis area was proposed as within Durham Region based on a preliminary identification of transportation problems and opportunities. For the purposes of providing an overview of existing agricultural conditions, the boundaries of the initial 407 East analysis area have been defined as Highway 35/115 to the east, Lake Ontario to the south, Brock Road to the west, and the Oak Ridges Moraine to the north (see **Figure 1**).

As mentioned, during the EA, the initial analysis area will be reviewed and refined to correspond with the recommended alternative (s) to the undertaking in consultation with agencies/public. The refined analysis area will be used for developing the alternatives methods and undertaking and determining potential effects on the environment.

3. Methodology

3.1 Available Secondary Source Information Collection and Review

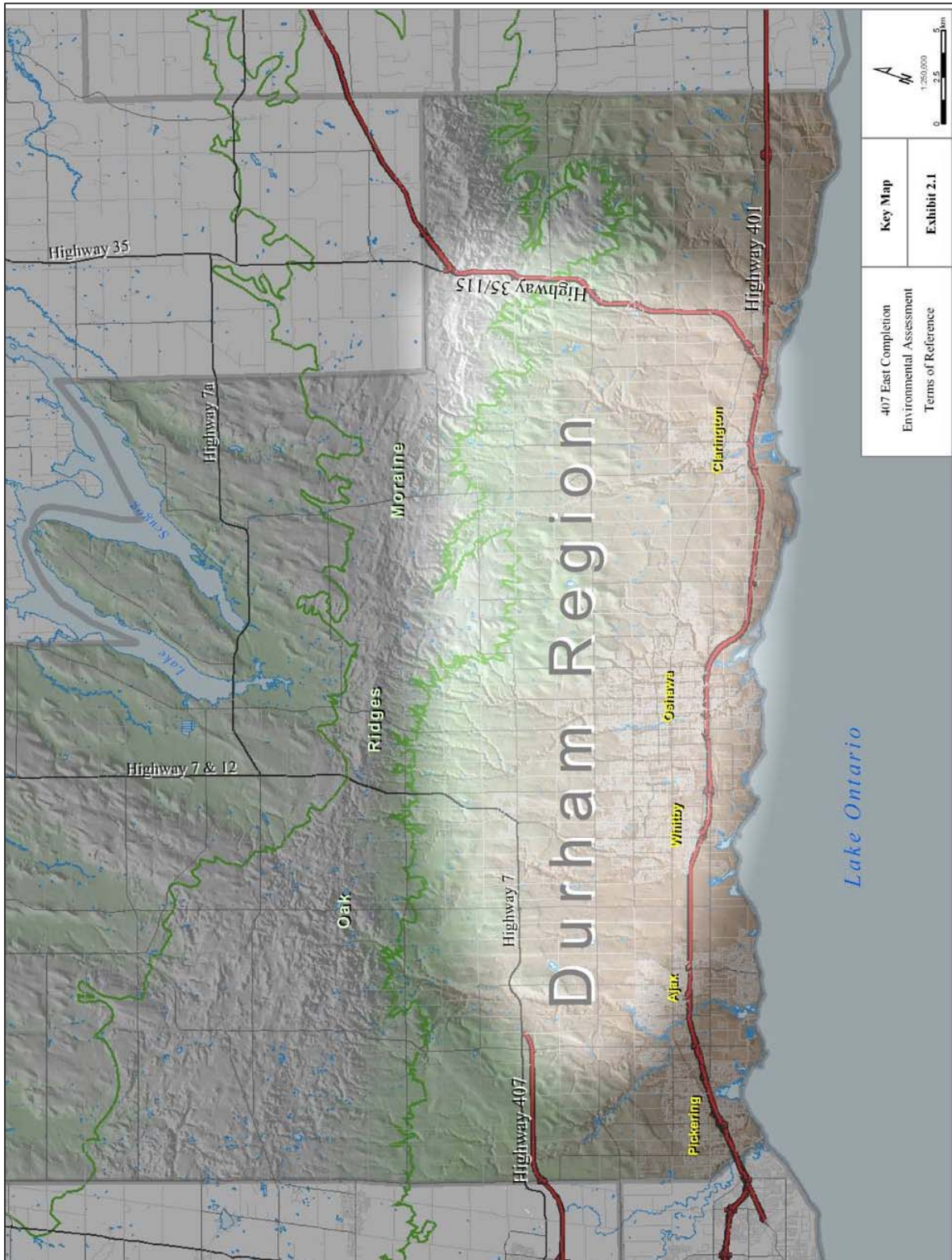
The approved ToR included a list of known available secondary sources of information (see Supporting Document C), which have been collected and reviewed as part of determining existing agricultural conditions. These sources of information are described as follows:

- *Soil Survey of Durham Region*; Report No. 9 of the Ontario Soil Survey. (Webber, L.R., F.F. Morwick and N.R. Richards, 1948).
- *Soil Survey of Formerly Ontario County (Now Western Portion of Region of Durham)*, Report Number 23 of the Ontario Soil Survey. (Olding, A.B., R.E. Wicklund and N.R. Richards, reprinted 1990).
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) digital soils data for Durham Region and the Region of York, 2005.
- 1:10000 scale Ministry of Natural Resources (MNR) Aerial Photography, 1978.
- 1:10000 scale Ontario Base Map (1983) Ministry of Natural Resources.
- 1:50000 scale NTS Map No 30 M/14 &15. 1984. Ministry of Energy Mines and Resources, Canada.
- 1:50000 scale NTS Map No 31 D/2 & 3. 1984. Ministry of Energy Mines and Resources, Canada.

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Figure 1. Analysis Area



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- 1:50000 scale NTS Map No 30 M/14 & 15. Canada Land Inventory (CLI) Capability Mapping.
- 1:50000 scale NTS Map No 31 D/2 & 3. Canada Land Inventory (CLI) Capability Mapping.
 - *The Canadian System of Soil Classification*. 3rd ed. Agric. Can. Publ. 1646. Agriculture Canada Expert Committee on Soil Survey. 1998.
 - *Ontario Ministry of Agriculture and Food - Land Use Systems Mapping*, (digital and hard copy for all townships within the analysis area).
 - *Ontario Ministry of Agriculture and Food - Artificial Drainage Mapping*, (hard copy for all Townships within the analysis area).
 - *The Physiography of Southern Ontario* 3rd Edition, Ontario Geological Survey Special Volume 2, Ministry of Natural Resources, 1984.
 - *The Durham Regional Official Plan*, (1993).
 - *The City of Pickering Official Plan*, (1997).
 - *The Town of Whitby Official Plan*.
 - *The City of Oshawa Official Plan*.
 - *The Town of Clarington Official Plan*.
 - *Provincial Policy Statement*, 2005.
 - *Provincial Policy Statement*, 1997.
 - *Minimum Distance Separation I (MDS I)*, Ontario Ministry of Agriculture, Food and Rural Affairs, March 1995.
 - *Guide to Agricultural Land Use*, Ontario Ministry of Agriculture, Food and Rural Affairs, March 1995.
 - Organic Growers and Operators listings for Ontario.
 - *Agricultural Resource Inventory*, Ontario Ministry of Agriculture and Food, 1988,
 - *Greenbelt Protection Plan* (The Greenbelt Act 2005).
 - *Canadian Environmental Assessment Act* (1992).
 - *Ontario Environmental Assessment Act* (1990).
 - Previously completed agricultural studies for the Highway 407.

3.2 Process Undertaken

3.2.1 Soil Investigation/Canada Land Inventory

Initial soils information was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). This information was provided in digital (shapefiles and associated databases) and hard copy format, and included the soil series names and Canada Land Inventory (CLI) rating for each soil

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polygon. It should be noted that the CLI ratings associated with the digital soils data was originally mapped at a scale of 1:63360 (1 inch to 1 mile) for the *Soil Survey of Formerly Ontario County* and at a scale of 1:126000 (1 inch to 2 miles) for the *Soil Survey of Durham Region*.

Canada Land Inventory mapping at 1:50000 scales were reviewed and correlated to the *Soil Survey of Formerly Ontario County* and to the *Soil Survey of Durham Region* to determine the most detailed soil capability ratings for common field crop.

3.2.2 Agricultural Land Use

Initial Agricultural Land Use data was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs. This information was provided in hard copy (paper mapped) format and identified the agricultural land usage for the analysis area. This information will provide a baseline for the identification of agricultural land use in the analysis area. It should be noted that the OMAFRA Land Use data are of older material and is not updated on a regular basis.

Agricultural land use data had been collected during previous studies completed as part of the Highway 407 original studies. These documents were reviewed to determine the extent of information available and the format the information (hard copy or digital). Data collected in the original studies included the identification of land use (both agricultural and non-agricultural), documentation of the type and location of agricultural facilities, non-farm residential units and non-farm buildings (businesses, storage facilities, industrial, commercial and institutional usage) for the original alignment.

Agricultural land use designations were correlated to the *Agricultural Resource Inventory* report and maps for the purpose of updating the Ontario Ministry of Agriculture and Food Land Use Systems mapping for the analysis area.

3.2.3 Agricultural Facilities

Agriculture facility information (type of farm operation, high capital investment) was provided in documentation from the previous Highway 407 studies. This information was reviewed to determine the extent of the information with respect to the updated 407 analysis area.

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3.2.4 Land Tenure

Land tenure/ownership and fragmentation (size of parcels) was provided as part of the documentation from the previous Highway 407 studies. This information was reviewed to determine the extent of the information with respect to the updated 407 analysis area.

3.2.5 Artificial Tile Drainage

Artificial tile drainage information provided as part of the documentation from the previous Highway 407 studies. This information was reviewed to determine the extent of the information with respect to the updated 407 analysis area. Further, newer artificial tile drainage information was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs.

3.2.6 Irrigation

Information on irrigation was provided in previous Highway 407 studies. This information was reviewed to determine the extent of the information with respect to the updated 407 analysis area.

3.2.7 Organic Farms

The location of Organic Farm operations was provided in previous Highway 407 work. This information was reviewed to determine the extent of the information with respect to the updated analysis area. The Canadian Organic Growers (COG) was contacted to determine the extent of their data set with respect to the updated 407 analysis area. The Organic Crop Producers & Processors Inc. was contacted to determine the extent of their data set with respect to the updated 407 analysis area.

3.3 Policy Review

Clearly defined and organized environmental practices are necessary for the conservation of land and resources. The *Ontario Environmental Assessment Act* (1990) was created to ‘provide protection, conservation and wise management in Ontario of the Environment.’ Similarly, the *Canadian Environmental Assessment Act* (1992) was created to ‘achieve sustainable development by conserving and enhancing environmental quality and by encouraging and promoting economic development that conserves and enhances environmental quality’.

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The long term protection of quality agricultural lands is a priority of the Province of Ontario and has been addressed in the Provincial Policy Statement (2005). Municipal Governments have similar regard for the protection and preservation of agricultural lands, and address their specific concerns within their respective Official Plans. With this in mind, the Provincial Policy Statement (2005 and 1997), the Official Plans of Durham, the Municipality of Clarington, the Cities of Pickering and Oshawa and the Towns of Ajax and Whitby were reviewed.

Further reviews were completed for the Greenbelt Plan (Greenbelt Act, 2005).

The Official Plan Policies and Greenbelt Plan documents were reviewed to verify if there were additional or specific agricultural components to be investigated when determining the potential impacts to agriculture.

3.3.1 Provincial Agricultural Policy

The Provincial Policy Statement (2005) was enacted to document the Ontario Provincial Governments development and land use planning strategies. The Provincial Policy Statement provides the policy foundation for regulating development and land use. The Provincial Policy Statement provides comment regarding regulations for Natural Heritage, Water, Agriculture, Minerals and Petroleum, Mineral Aggregate Resources and Cultural Heritage and Archaeology.

Agricultural policies are addressed within Section 2.3 of the Provincial Policy Statement. Section 2.3.1 states that 'Prime agricultural areas shall be protected for long term use for agriculture.' Prime agricultural areas were defined as Specialty Crop Areas and Classes 1 – 3 lands with the order of preservation being Specialty Crop Areas, Classes 1, 2 and 3 in that order respectively.

Section 2.3.5 indicates that an area may be excluded from prime agricultural areas only for: an expansion of settlement areas, in accordance with policy 1.1.3.9; extraction of minerals, petroleum resources and mineral resources, in accordance with policies 2.4 and 2.5; and limited non-residential uses, provided that:

- the land does not comprise a specialty crop area;
- there is a demonstrated need within the planning horizon provided for in policy 1.1.2 for additional land to be designated to accommodate the proposed use;
- there are no reasonable alternative locations which avoid prime agricultural areas; and
- there are no reasonable alternative locations in prime agricultural areas with lower priority agricultural lands.

Further, that impact from any new non-agricultural uses on surrounding agricultural operations and lands will be mitigated.

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3.3.2 Official Plan Policy

Official Plan policies are prepared under the Planning Act, as amended, of the Province of Ontario. Official Plans generally provide policy comment for land use planning while taking into consideration for economic, social and environmental impacts of land use and development concerns. For the purpose of this report the Official Plans of Durham Region, the Municipality of Clarington, the Cities of Pickering and Oshawa and the Towns of Ajax and Whitby were reviewed.

4. Existing Agricultural Conditions

4.1 Results

4.1.1 Physical Characteristics

The physiographic resources within the analysis area, as documented with available resources, are described in this section.

4.1.2 Physiography and Climate

The *Physiography of Southern Ontario* Physiographic Unit Map indicates that the analysis area is located within the Iroquois Plain, the South Slope and the Oak Ridges Moraine physiographic regions.

The Iroquois Plain Region is described as the lowland bordering Lake Ontario. Specific to this project, the Scarborough to Newcastle section is documented. The area across the Region of Durham is described as fairly level and often poorly drained. A drier sandy terrace is noted north of Oshawa. The rest of the plain is a complex mix of till plains, drumlins and areas of silty lacustrine deposits. The South Slope Region is described as the southern slope of the Oak Ridges Moraine. The soils in this Region have developed on a variety of soil materials including heavy calcareous glacial till materials, gravels and sand deposits. In the Region of Durham, the South Slope Physiographic Region is characterized as comprising numerous scattered drumlins. Streams in the South Slope Region flow directly downhill and have created deeply incised valleys. The Oak Ridges Moraine Physiographic Region is described as extending from the Niagara Escarpment to the Trent River, forming a height of land dividing the streams of the Lake Ontario drainage basin from those flowing into Georgian Bay and the Trent River. For the most part these hills are composed of coarser materials such as sands and gravels.

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The analysis area is located within the 2900 – 3200 average accumulated Crop Heat Units available for warm season crops in Ontario. The Crop Heat Units (CHU) index was originally developed for field corn and has been in use in Ontario for 30 years. The CHU ratings are based on the total accumulated crop heat units for the frost free growing season in each area of the province. CHU averages range between <2100 east of Parry Sound to over 3500 near Windsor. The higher the CHU value, the longer the growing season and greater are the opportunities for growing value crops.

4.1.3 Soil Capability for Agriculture

Basic information about the soils of Ontario is made more useful by providing an interpretation of the agricultural capability of the soil for various crops. The Canada Land Inventory (CLI) system combines attributes of the soil to place the soils into a seven-class system of land use capabilities. The CLI soil capability classification system groups mineral soils according to their potentialities and limitations for agricultural use. The first three classes are considered capable of sustained production of common field crops, the fourth is marginal for sustained agriculture, the fifth is capable for use of permanent pasture and hay, the sixth for wild pasture and the seventh class is for soils or landforms incapable for use for arable culture or permanent pasture. Organic or Muck soils are not classified under this system.

Canada Land Inventory (CLI) ratings were supplied in the soils data provided by OMAFRA and on the 1:50000 scale manuscript mapping. This scale is appropriate for generating alternate route alignments, however, when comparing individual routes, it may be necessary to complete on-site soil surveys to update the existing soils survey information.

4.2 Agricultural Land Use

The analysis area consists of a variety of land uses including, but not limited to, agriculture, light industrial/commercial, government/institutional, aggregate operations, open field, residential estate, built up areas, recreational and woodlots.

Agricultural land use was documented in the original Highway 407 reporting for that proposed route. These reports, maps and data will be updated to reflect the present analysis area and proposed route alignments.

The Ontario Ministry of Agriculture, Food and Rural Affairs maintain datasets for agricultural land use. These data sets are available in hard copy only for the analysis area. It should also be noted that the agricultural land use information is often of older or dated material and will be used for comparative purposes and for areas that may not be visible during the proposed roadside surveys. Roadside evaluations are often limited by ‘line of sight’ restrictions. Therefore, topography and vegetation may

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preclude an accurate assessment of individual agricultural facilities and land use. With this in mind, recent aerial photography will be used to assist in the identification and assessment of any partially or totally concealed agricultural facilities or fields as a result of topographic or vegetative encumbrance.

4.3 Land Tenure

Land tenure/ownership was reviewed from information provided in the previous Highway 407 studies. Land tenure was reviewed to determine the extent of local owner, non local owner and severed (smaller) parcels within the analysis area. The information from the previous studies is of older material and will be updated as part of the 407 Study.

All land tenure/ownership information will be reviewed and correlated to the latest available information from the municipalities.

4.4 Agricultural Investment

Agricultural investment is directly related to the increase in capital investment to agricultural lands and facilities. As a result, these lands and facilities are more worthy of preservation than similar capability lands and facilities with no increase in agricultural investment. The investment to agriculture is often readily identifiable through observations of the facilities. Agricultural activities such as livestock rearing usually involve a greater investment in agricultural facilities than a cash crop operation. Dairy operations require extensive facilities for the production of raw milk. Poultry and hog operations require facilities specific for those operations. Beef production, hobby horse and sheep operations usually require less investment capital. Some cash crop operations are considered as having a large investment in agriculture if they have facilities that include grain handling equipment such as storage, grain driers and mixing equipment.

Other types of investment in agriculture are associated with artificial tile drainage, irrigation operations, landforming to provide suitable production topography by levelling or terracing fields, and by utilizing organic farming techniques.

4.4.1 Agricultural Facilities

Agricultural facilities were identified and documented in the original Highway 407 reporting. The majority of the data sheets, tables and comments for these farm operations were collected from the Ministry of Transportation Highway 407 archives.

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The Ontario Ministry of Agriculture, Food and Rural Affairs do not maintain a database of agricultural operations or facilities.

All agricultural operations/facilities will be reviewed in the field to determine the extent (if any) of upgrades to the operations and to document the existing conditions of each operation.

4.4.2 Artificial Drainage

Artificial drainage involves the construction of or installation of tile drains in agricultural fields to reduce the excess water in the soil profile. The installation of tile drainage is an expense incurred by the landowner and as a result it is considered an investment in agriculture.

An evaluation of artificial drainage on the analysis area was completed through a review of the Ontario Ministry of Agriculture and Food (OMAF) Artificial Drainage System Mapping.

OMAFRA Artificial Drainage System Maps (in digital format) were reviewed to determine if an agricultural tile drainage system had been registered for properties within the analysis area. The OMAFRA maps revealed that agricultural drainage systems were registered to a few properties in the southern portion of the analysis area.

4.4.3 Irrigation

Irrigation equipment is used to provide water to crops in a timely fashion. Irrigation equipment may be owned by the farm operator or rented as required for the crop. The use of such equipment is an expense to the operation and is considered an investment in agriculture.

The Ontario Ministry of Agriculture, Food and Rural Affairs does not maintain a database documenting the location of irrigated fields or of areas that might be appropriate for irrigation activities.

Therefore, any information regarding the use of irrigation equipment will be collected during field surveys.

Visual evidence supporting the use of irrigation equipment would include the presence of the irrigation equipment (piping, water guns, sprayers, tubing, etc), the presence of a body of water capable of sustaining the irrigation operation and lands that have appropriate topography for the use of such equipment.

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4.4.4 Landforming

Landforming is a term applied to describe the physical moving of soil materials to level fields or lessen slopes to accommodate the use of farm equipment. Large construction equipment is required for these operations. The process of landforming is an expensive task and is considered an investment in agriculture.

The Ontario Ministry of Agriculture, Food and Rural Affairs do not maintain a database for these activities.

4.4.5 Organic farming

Organic farming is a production management system that is based on the minimal use of off-farm inputs. Organic is a labelling term that denotes that a farm has been certified and adheres to standards that maintain the integrity of organic agricultural products.

Organic farms must go through a certification process to achieve the Organic Status. These farms are susceptible to wind blown contaminants and as such should be documented as to proximity to the proposed undertaking.

The Canadian Organic Growers (COG) was contacted to determine the extent (if any) of certified organic agricultural operations in the analysis area. No certified organic agricultural operations were identified within their COG database. Similarly, the Organic Crop Producers & Processors Inc. was contacted to determine the extent of their membership, the type of database and whether such data are available for public use. At the time of writing this report, discussions were still taking place to determine these issues.

Organic operations may be observed during the windshield surveys. The determination of organic operations is usually made through signage near the farm operation.

4.5 Minimum Distance Separation I

The Minimum Distance Separation (MDS) calculation is a tool provided by the Ontario Ministry of Agriculture and Food, and used to determine a recommended distance between a livestock operation and another land use. The objective is to prevent land use conflicts and to minimize nuisance complaints from odour (the MDS does not account for noise and dust issues). The MDS is based on a number of variables including: type of livestock; numbers of animals; size of the farm operation; type of manure system and the form of the development proposed. MDS I calculations are employed to determine the minimum distance separation for new development from existing livestock facilities, while MDS II calculations are used to determine the minimum distance separation for new or expanding livestock facilities from existing or approved development.

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5. Conclusions

As part of the approved ToR, an initial 407 East EA analysis area was proposed as within and surrounding Durham Region based on a preliminary identification of transportation problems and opportunities. As a result, the analysis area presently includes eight area municipalities including the Cities of Oshawa and Pickering, the Towns of Ajax, and Whitby; the Municipality of Clarington and the Townships of Brock, Scugog and Uxbridge.

This EA will be carried out in accordance with the approved procedure created to protect the environment in compliance with Ontario's *Environmental Assessment Act* (OEAA) and the *Canadian Environmental Assessment Act* (CEAA).

Specifically, this report documented the existing agricultural conditions as determined through secondary data resource reviews.

Previous studies completed for the Highway 407 provided a major data source specific to documenting agricultural conditions. These documents provide site-specific information for farm operations, land tenure, fragmentation land use and to a certain extent tile drainage location. This information will be used as a base for future agricultural land use and operation studies. It should be noted that the original Highway 407 studies focused on a smaller area and as such this study will build on and update the previous work.

The results of this assessment indicate the following:

- The analysis area is located within the Iroquois Plain, Slope South and Oakridges Physiographic Regions. The analysis area comprises a variety of landforms including drumlins, moraines, lacustrine deposits, stream and deeply incised valleys.
- The analysis area Crop Heat Units range from 2900 to 3200 units. This information was available for the entire analysis area.
- The soils and Canada Land Inventory (CLI) ratings for common field crop were supplied by the Ontario Ministry of Agriculture, Food and Rural Affairs. Soils data was presented in digital format with scales that ranged from 1:63360 to 1:126000. Canada Land Inventory ratings were supplied with the soils data and at the same scales. Canada Land Inventory Ratings were also supplied at a 1:50000 scale in digital format. This information was available for the entire analysis area.

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- Land tenure/ownership information presented in previous reports is older material and should be updated to reflect the current conditions of ownership and fragmentation.
- Artificial drainage mapping in hard copy (paper) format was supplied by the Ontario Ministry of Agriculture, Food and Rural Affairs. These data was available for the entire analysis area.
- Agricultural land use information was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, in hard copy, for the entire analysis area. This information is of older, dated materials.
- Investment in agriculture information related to agricultural operations/facilities was reviewed from previous studies. This information was incomplete and did not cover the present analysis area.
- Similarly, investment in agriculture related to landforming, irrigation and Organic Farming operations was reviewed. This information was incomplete and did not cover the present analysis area.
- As per comments received from staff of the Ontario Ministry of Agriculture, Food and Rural Affairs, Minimum Distance Separation Calculations were not required as part of an EA study if the project is a highway.

6. Recommendations/Further Work

Based on the state of information collected for the agricultural component of this EA study, it is recommended that the following work be completed to fill all datasets:

- update and complete the assessment of agricultural facilities/operations through windshield surveys, comments received at the Public Information Centres (PIC) and select owner interviews;
- update and complete the assessment of agricultural land use;
- update and complete the assessment of land tenure/ownership and fragmentation;

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- update and complete the assessment of tile drainage use through aerial photographic interpretation and windshield surveys;
- update soils information at appropriate scale for detailed design work through onsite and/or roadside surveys;
- update and complete the assessment of Organic Farm operators through continued discussions with the various Organic Certification Organizations;
- complete all relevant digital mapping for the agricultural component of the Environmental Assessment.

Report Prepared and Reviewed By:

Dave Hodgson
DBH Soil Services Inc.

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7. References

- 1:10000 scale Ministry of Natural Resources (MNR) Aerial Photography, 1978.
- 1:10000 scale Ontario Base Map (1983) Ministry of Natural Resources.
- 1:50000 scale NTS Map No 30 M/14 &15. 1984. Ministry of Energy Mines and Resources, Canada.
- 1:50000 scale NTS Map No 31 D/2 & 3. 1984. Ministry of Energy Mines and Resources, Canada.
- 1:50000 scale NTS Map No 30 M/14 &15. Canada Land Inventory (CLI) Capability Mapping.
- 1:50000 scale NTS Map No 31 D/2 & 3. Canada Land Inventory (CLI) Capability Mapping.
- *Agricultural Resource Inventory*, Ontario Ministry of Agriculture and Food, 1988.
- *Canadian Environmental Assessment Act* (1992).
- *Greenbelt Protection Plan* (The Greenbelt Act 2005).
- *Guide to Agricultural Land Use*, Ontario Ministry of Agriculture, Food and Rural Affairs, March 1995.
- Minimum Distance Separation I (MDS I), Ontario Ministry of Agriculture, Food and Rural Affairs, March 1995.
- Ontario Ministry of Agriculture and Food - Land Use Systems Mapping, (digital and hard copy for all townships within the analysis area).
- Ontario Ministry of Agriculture and Food - Artificial Drainage Mapping,(hard copy for all Townships within the analysis area).
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) digital soils data for Durham Region and the Region of York, 2005.
- Organic Growers and Operators listings for Ontario.
- *Ontario Environmental Assessment Act* (1990).
- Previously completed agricultural studies for the Highway 407.
- *Provincial Policy Statement*, 2005.
- *Provincial Policy Statement*, 1997.
- *Soil Survey of Durham Region*; Report No. 9 of the Ontario Soil Survey. (Webber, L.R., F.F. Morwick and N.R. Richards, 1948).
- *Soil Survey of Formerly Ontario County (Now Western Portion of Region of Durham)*, Report Number 23 of the Ontario Soil Survey. (Olding, A.B., R.E. Wicklund and N.R. Richards, reprinted 1990).
- *The Canadian System of Soil Classification*. 3rd ed. Agric. Can. Publ. 1646. Agriculture Canada Expert Committee on Soil Survey. 1998.

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- *The City of Pickering Official Plan, (1997).*
- *The City of Oshawa Official Plan.*
- *The Durham Regional Official Plan, (1993).*
- *The Physiography of Southern Ontario 3rd Edition, Ontario Geological Survey Special Volume 2, Ministry of Natural Resources, 1984.*
- *The Town of Clarington Official Plan.*
- *The Town of Whitby Official Plan.*