The Honewood Soils Series and Potato Production in Dufferin County, Ontario

May 25, 2010

Prepared by:

Dr. J. Kenneth Torrance
B.S.A. Ontario Agricultural College;
M.S. (Soil Science); Ph.D. (Soil Science) Cornell University
Professor Emeritus, Geography and Environmental Studies
Carleton University, Ottawa, Ontario, Canada, K1S 5B6

For:

North Dufferin Agricultural and Community Taskforce Inc. (NDACT)

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Purpose

The purpose of this report is to indicate why in my opinion as a soil scientist, the area of Dufferin County as shown on the attached **Figure 1**, satisfies the criteria of

> "soils that have suitability to produce specialty crops or lands that are subject to special climate conditions or a combination of both[1].

Background

I have extensive personal familiarity with Dufferin County and that coupled with my qualifications as a soil scientist is the basis for the opinions expressed in this report.

To the best of my knowledge, no record exists of when potatoes were first grown in Dufferin County, but, with the potato being a staple of the diet of the English, Irish and Scots who settled in the area, it is safe to assume that potatoes were among the first vegetables planted in the home gardens. My family connection to the Honeywood soil series dates back to 1869, when my great grandfather, Thomas Torrance purchased the East half of Lot 24, Concession 4, Amaranth Township, and later the West half. My grandfather, George Torrance, and then my father, Harold Torrance, farmed this land until 1945, when my father purchased Lot 20, Concession 2, north of Hornings Mills in Melancthon Township. All the soil on the Melancthon farm is Honeywood silt loam.

Potatoes were a cash crop, of limited acreage, on most farms in the Honeywood and Hornings Mills areas in the late 1940s. Their importance increased during the 1950s as tractors became more powerful. Greater power, larger plows, the multiple-row potato planter and the potato harvester greatly reduced the time and labour requirements for potato production. By 1960, when our Melancthon farm was sold, potatoes were the dominant crop in the area. This dominance has continued and strengthened on the Honeywood soils, particularly on the major continuous block of Honeywood silt loam lying to the west of a line between Honeywood and Horning's Mills and extending to and beyond the 5th line of Melancthon (see the Soil Survey of Dufferin County, 1964).

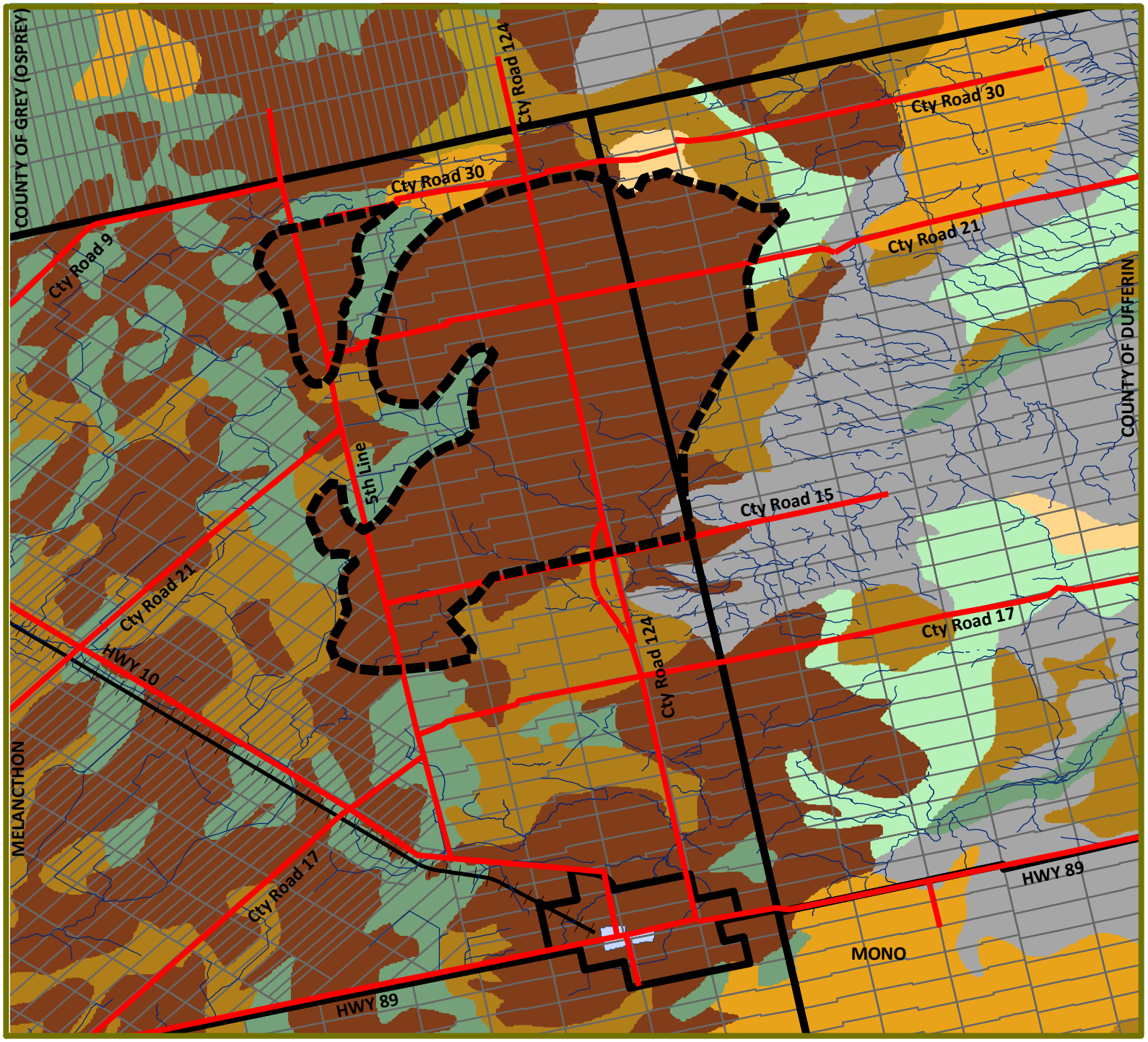
It is logical to suggest that there must be something about the Honeywood silt loam and where it occurs that makes it particularly suited to potato production. Let us examine the evidence by considering the optimum climatic and soil conditions for potato production.

Soil Requirements for Potato Production

The optimum soil conditions for potato production are defined in terms of drainage, texture, stoniness, and topography. Manitoba Agriculture has defined suitability classes for irrigated potato production as being: 1) soils are well to rapidly drained; 2) soil textures usually range from loamy very fine sand, sandy loam, to loam; 3) soils are non- stony; 4) the topography is level to very gently sloping (0-5%); and 6) salinity levels are low. (http://www.gov.mb.ca/agriculture/soilwater/soilsurvey/fss01s03.html)

For non-irrigated production systems, optimal conditions change slightly and are that: well drained soils are preferable to rapidly drained soil; and that silty and fine-sand textures are preferable to

[1] Ontario Provincial Policy Statement 2005, Definitions pg 37.



1 - Soils in this class have no significant limitations in use for crops

2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices

3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices

4 - Soils in this class have severe limitations that restrict the range of crops or require special conservation practices

5 - Soils in this class have very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible

6 - Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible

7 - Soils in this class have no capacity for arable culture or permanent pasture

O - Organic Soils (not placed in capability classes)

FIGURE 1

Area for Consideration as Locally Significant Specialty Crop Area

SOIL CAPABILITY FOR AGRICULTURE

GEOGRAPHIC TOWNSHIPS OF
MELANCTHON - MULMUR - OSPREY

N
W E
S

0 1,500 3,000 6,000
Meters

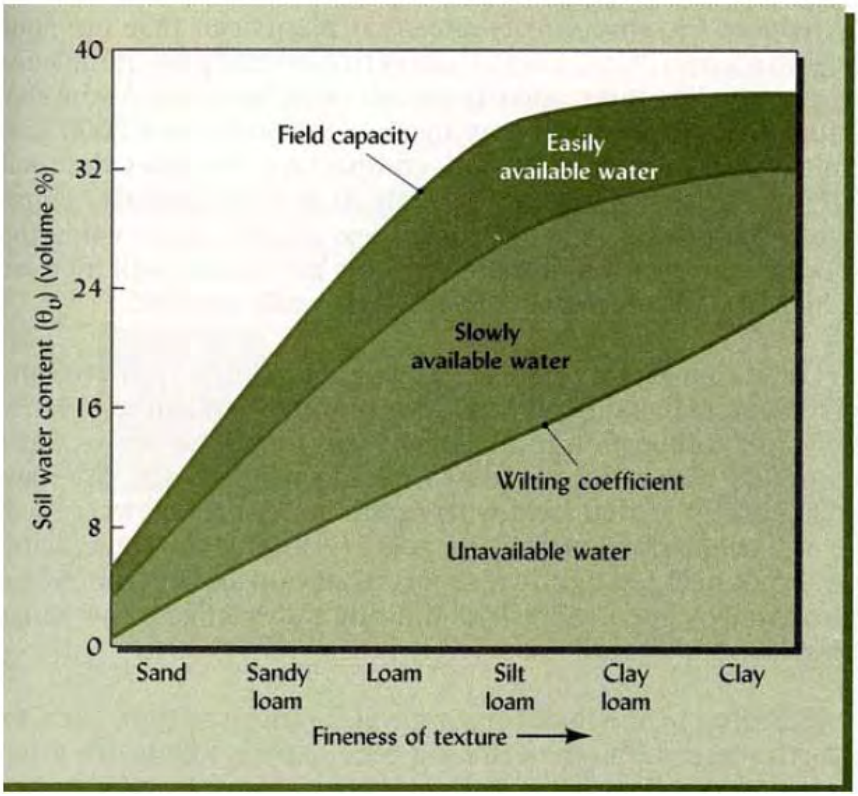
PLANSCAPE
Building Community Through Planning

Base Mapping Source:
Geogratis - Soil Capability for Agriculture - 041a
Land Information Ontario

July 23, 2010

sandier textures. Poor drainage renders the potato susceptible to several bacterial and viral infections. The preference for silty and fine sand soils relates to the ability of medium-textured soils to retain greater amounts of water against the force of gravity (the field capacity) than sandier soils and to hold a greater total amount of plant-available water (the water held in the soil at energy levels between the field capacity and the wilting coefficient) (see **Figure 2**). A study by Webber and Tel (1966) confirms that the Honeywood silt loam is among the best soils in Ontario in terms of its ability to retain plant available water. Potatoes grown on soils with high clay content are more prone to disease and tubers are more likely to be misshapen (Parker, 2010). In addition, soils with high clay content are more likely to cling to the tuber during harvest.

The natural fertility of the soil is not a major factor because chemical fertilization is necessary on most soils to obtain profitable yields. Silt textured soils are less prone to leaching of the fertilizers than are coarser textured soils. Leaching of fertilizers and pesticides to the water table is not desirable. Salinity is not a concern in humid regions such as Ontario. The pH of the soil, not included in the Manitoba criteria, should be between 5.0 and 6.5 (Parker, 2010; Ghaffari et al, 2000). Higher pH renders the potato susceptible to scab. Potato roots may extend to 70 cm depth (Ghaffari et al, 2000) with the consequence that for optimum growth in non-irrigated conditions soil depth should exceed 60cm (Ghaffari et al, 2000). The topographic requirement arises because potato is a cultivated crop which renders the land prone to erosion, and because planting, cultivation and picking operations are facilitated by slopes being less than 4-5%.



[Figure 2: The general relationship between soil water characteristics and soil texture. (From: Brady and Weil, 2008).]

In summary, the soil conditions for Class 1 land for potato production under non-irrigated conditions are:

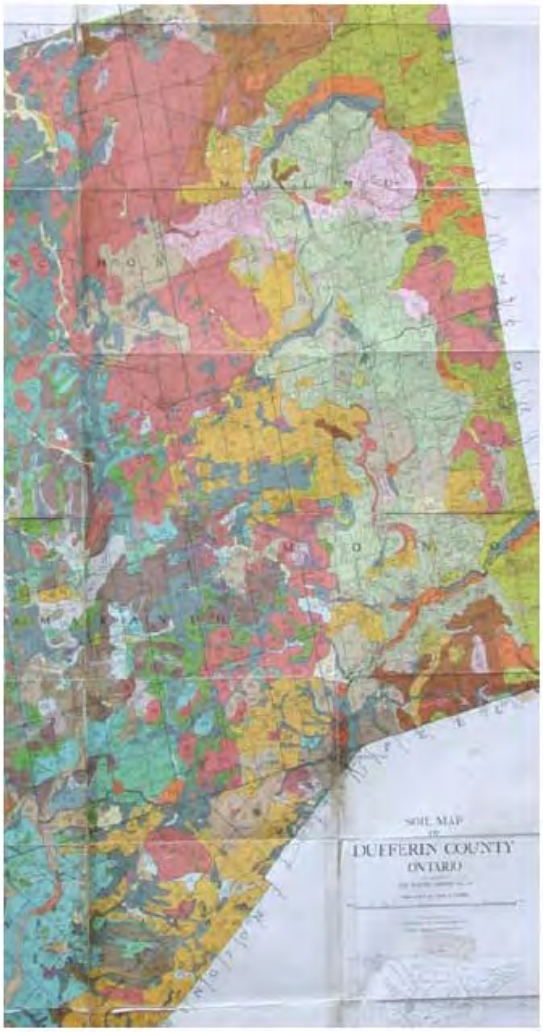
1. soil is well drained
2. soil texture should be in the range from very fine sand to silt loam and loam
3. soil is non-stony
4. topography is level to very gently sloping (0-5%)

5. soil depth should exceed 60 cm
6. soil pH should be between 5.0 and 6.5
7. salinity should be low.

The Honeywood Soil

The Honeywood soil is the well-drained member of the Honeywood catena. A catena is a sequence of soils developed on the same parent material under drainage conditions ranging from well drained to poorly drained. The other catena members are the imperfectly drained Embro soil and the poorly drained Crombie soil. The parent material of the Honeywood catena is "wind-deposited silt loam or fine sandy loam materials which are underlain by calcareous loam till ..." (Soil Survey of Dufferin County, 1964). The depth to the till boundary may be as shallow as two feet (60 cm) or as deep as five feet (150cm).

Honeywood catena soils are restricted to Dufferin County **(Figure 3)** and to an area of Honeywood-Guelph complex soils in Oxford County (Soil Survey of Oxford County, 1961). In Dufferin County, they are distributed as two major 'blocks' and a series of smaller areas. The largest block extends, roughly, from the intersection of the 4th line and 15 sideroad of Melancthon northward to 30 sideroad north of Redickville and extends eastward to Horning's Mills and Honeywood, and extends one to two concessions into Mulmur; this will be called the HRH block. The second large block surrounds Shelburne in southern Melancthon and northern Amaranth, and extends northeastward to about 2 km southwest of Whitfield in Mulmur. A number of small areas lie west of the HRH block, south through eastern Amaranth and western Mono, and into East Garafraxa Township. Two areas lie near the Mulmur and Mono boundary with Simcoe County, but they are generally more steeply sloping than is desirable for potato production.



[Figure 3: The location of the Honeywood soils within Dufferin County (Soil Survey of Dufferin County, 1964).]

The taxonomic classification, profile description and analytical data for the Honeywood soil series are presented in **Figure 4**, and the soil surveyors' commentary is presented in **Figure 5**.

The soil survey report identifies that the Honeywood soils "are among the best agricultural soils in Southern Ontario and are capable of producing all crops adapted to the area". In 1964 those crops were listed as potato, cereal grains, hay and silage corn. With subsequent development of shorter season varieties, grain corn and beans can be added to the list. It was noted that, even in the early 1960s, "large acreages of potatoes are grown in the region around Redickville and Honeywood." In the two large areas of the Honeywood soils, the Honeywood-Horning's Mills and west area and the area surrounding Shelburne, the land capability rating for agriculture is Class 1.

Potato production in Dufferin County has been concentrated on the Honeywood silt loam in Melancthon and Mulmur townships and on the Hillsburgh sandy loam in East Garafraxa township. The Hillsburgh sandy loams are the only other soils identified with potato production in the soil survey report; they are called "excellent potato soils' in the surveyors' commentary. This designation is somewhat inconsistent with their land capability for agriculture rating. The Hillsburgh soils on 0-5% slopes are ranked in Class 3s (limitations of low fertility, low water holding capacity or poor structure); Those on 6-9% slopes are ranked as Class 4s; and those on 10-15% slopes are ranked as 6t (topography is a limitation). The interpretation to place on the "excellent potato soil" commentary is that the Hillsburgh soils, in the 1960s, are better for potatoes than for any other climatically adapted crop, despite their limitations. This interpretation may still apply. Whether the Hillsburgh soils are "excellent" for potatoes is debatable. In contrast, the Honeywood soils are identified as Class 1 (i.e. excellent) for all adapted crops.

HONEYWOOD SERIES

Location: Concession III E, Lot 20, Melancthon Township
Parent Material: Loess or alluvium over loam till
Classification:
Order — Podzolic
Great Group — Grey-Brown Podzolic
Sub Group — Brunisolic Grey-Brown Podzolic
Family — Honeywood

Description:

Ah	—0 to 3 inches silt loan; dark gray (10YR4/1); medium granular structure; friable consistency; stonefree; pH 6.6.
Ae1	—3 to 12 inches silt loam, yellowish brown (10YR5/6); fine granular; friable; stonefree; pH 6.6.
Ae2	—12 to 17 inches fine sandy loam; light yellowish brown; weak fine crumb; very friable; stonefree; pH 6.0.
Ae3	—17 to 29 inches fine sandy loam; light brown (7.5YR6/4); weak fine crumb; very friable; stonefree; pH 6.4.
Bt	—29 to 37 inches silt loam; dark brown (7.5YR4/4); medium subangular blocky; firm; stonefree; pH 7.2.
IIC	—Loam till; light brown (7.5YR6/4); medium blocky; hard; moderately stony; calcareous; pH 7.8.

[**Figure 4**: Taxonomic classification, profile description and analytical data for the Honeywood Soil (Soil Survey of Dufferin County, 1964).]

HONEYWOOD SERIES

The Honeywood soils are found in most of the townships in the county but occur chiefly through the central portion from Honeywood to Orangeville. The largest continuous area is located between Honeywood and Shelburne. These soils occupy 45,200 acres — almost 13 per cent of the total county area.

The Honeywood soils are well drained and have developed in wind-deposited silt loam or fine sandy loam materials which are underlain by calcareous loam till at two to four feet. The till appears to be similar to that of the Harriston soils. The materials overlying the till are remarkably uniform, maintaining an average thickness of three feet even where the topography is rough and short steep slopes prevail. In general, the silty overburden is thicker on the eastern side of the county.

These soils occur principally on gently undulating topography except for steeper slopes in an area south of Stanton. The soil surface is usually stonefree but ice-rafted boulders are numerous in a few fields. External drainage is moderate and internal drainage is medium.

Grey-Brown Podzolic characteristics arc well expressed in the Honeywood soils. The surface soil is a very dark grayish brown silt loam or fine sandy loam about four inches thick in uncultivated areas. On being cultivated part of the subsurface is mixed with the surface to form a thicker, lighter colored surface layer. The Ac horizons are about 30 inches thick, their yellowish brown color becoming lighter with depth. The at horizon is dark brown and is located immediately above the calcareous loam till. Stones occur only in the till.

The Honeywood soils are among the best agricultural soils in Southern Ontario and are capable of producing all crops adapted to the area. In Dufferin County these soils are used mainly for livestock raising, dairying and potato growing. Cereal grains, hay, pasture and some silage corn are grown. Large acreages of potatoes are grown in the region around Redickville and Honeywood.

The surface soil is friable, easily worked and contains a good reserve of plant nutrients. These soils drain rapidly and have a sufficiently high moisture holding capacity to supply plants with moisture even during the dry period of the year.

Figure 5: Honeywood soil series: soil surveyors commentary (Soil Survey of Dufferin County, 1964).

Let us now compare the soil and agroclimatic situation of the Honeywood soils with the optimum conditions for potato production.

Sunohara (1996) studied the effect of intensive potato production on the properties of the Honeywood silt loam on farms in the Redickville-Horning's Mills area. He compared the properties of the soil on farms where potatoes had been intensively produced since the early l960s with the soil on a mixed farm where potatoes had not been grown in the rotation, and with the soil from a woodlot. Compared to the woodlot and mixed farms sites, the soils under intensive potato production had lower organic matter content in their surface (A) horizons, greater bulk density (compaction) in their subsurface (B) horizons and lower pH down to 50 cm. The soil on the mixed farm had: slightly lower organic matter content than the woodlot soil; comparable bulk density (no compaction) in its B horizon; and slightly lower pH. It was recommended that management practices should be modified to alleviate the risk of compaction reaching problematic levels.

The Honeywood Soil Properties and Potato Preferences

Let us do a checklist (**Table 1**) of the properties of the Honeywood soil (Figure 4) with the soil properties that would qualify a soil to be considered Class 1 for potatoes. The Honeywood soils on slopes of 0-5% meet all of these criteria; one can legitimately argue that, in terms of the soil properties, they are as close to being an "ideal" soil for potatoes as one is likely to find anywhere.

Property	Soil property requirement	Honeywood soil
Drainage	well drained	well drained
Texture	from very fine sand to silt loam and loam	silt loam and fine sandy loam
Stoniness	non-stony	non-stony
Topography	level to very gently sloping (0-5%)	mostly level to very gently sloping (0-5%)
Depth	should exceed 60 cm	normally exceeds 60 cm
pH	5.0 to 6.5	6.0 to 6.6 from 0-70 cm
Salinity	low	low

[Table 1: Comparison of Honeywood soil properties with the requirements of a Class 1 potato soil.]

In summary the areas occupied by Honeywood soil in Dufferin County are unique in terms of their geomorphological origin, their soil properties and the agro-climate in which they are found. Geomorphological: The Honeywood soil has developed in the most well drained and thickest parts of the loess cap that was laid down over calcareous till in the first areas of Southern Ontario to become ice-free during the retreat of the Wisconsinan glaciation. The northern parcel has been reported to be where this loess layer is at its deepest. Soil properties: The silt loam soil is ideal for potato production because of its ability to store large amounts of plant-available water, which renders it much less drought prone than sandier soils and than most of the soils developed on glacial tills and on clayey sediments. Its silt texture allows for good tuber formation and growth and the soil does not stick to the tuber upon harvest. Agroclimate: The agroclimate of the higher elevation parts of Dufferin County.is the best for potato production in southern Ontario. The temperature during the growing season for potatoes is the coolest in SW Ontario, because of this higher elevation. The area of Honeywood soil in Oxford County is at lower elevation and its agroclimate is inferior for potato production. The climate approximates the ideal agroclimate for potatoes. Other areas of Ontario can bring potatoes to market earlier because of earlier planting dates, but the Dufferin agroclimate provides for higher dry matter content and superior quality for eating, storage and processing. In short, the Honeywood soil in the agroclimatic situation of Dufferin County is as close to an ideal soil for potato production as exists in Ontario, and arguably, in Canada.

The Agroclimate of Dufferin County and Potato Preferences

Potatoes, while being a very versatile crop, have a climatic preference for temperate regions or for the cool seasons in warmer areas of the world. Parker (2010) presents the temperature preferences at various stages of potato development. Soil temperatures during the growing season are particularly important. Sprouting is retarded at soil temperatures below 11°C, and is most rapid at about 22°C. Tuber formation is favoured by soil temperatures between 11-20°C; it is retarded between 22-25°C and ceases at soil temperatures over 29°C. Tuber initiation is affected by both day length and temperature.

Short days encourage tuber initiation; if days are long, tuber initiation occurs if night time air temperatures are below 20°C. The optimum soil temperature for maximum yield is variety dependent. Tuber abnormalities occur if the temperature is too high. Above the optimum temperature, yield is decreased by about 7% for every 1°C above the optimum temperature. The frost-free period should range for 90-120 days, depending on variety.

The preferred climate conditions for potato production are:

1. cool temperate conditions
2. soil temperatures near 22°C at planting time
3. night time temperatures <20°C during tuber initiation period
4. soil temperatures <22°C during tuber growth period
5. frost-free period exceeds 90 days

Dufferin County and adjacent areas of Grey County to the northwest have the highest elevations in southwestern Ontario. The Honeywood-Horning's Mills area mostly lies in the 490-520 m range. These areas represent the headwater areas of the Nottawasaga and Grand Rivers, which flow into Georgian Bay of Lake Huron and Lake Erie, respectively. Environment Canada has long term climate data for four sites in and near Dufferin County: Monticello in the northwest of East Luther Township; Proton Station in Grey County, approximately 6 km west of Melancthon Township at the same latitude as Honeywood; Grand Valley in the southeast of East Luther Township; Orangeville in the southwest of Mono Township; and Alliston in Simcoe County, approximately 10 km east of Mulmur Township at the same latitude as Horning's Mills. The elevation, mean annual precipitation, May-September precipitation and monthly average temperatures from May- September are presented in Table 2; the sites are arranged by decreasing elevation. The same data is provided for Guelph, Woodstock (in Oxford County), Dashwood (near Grand Bend), Delhi (near Simcoe) and Kingsville (near Leamington), all in Ontario, for comparison purposes.

The May-September data is displayed because the normal planting period for potatoes in Dufferin County is late May to early June, at which time the average daily temperatures (over the 24 hour period) is approximately 14-15 °C, closer to the June average than the May average. Through the main growing season, late June through September, it is mostly between 16 and 19 °C. The temperature (14-15 °C) during the sprouting period (late May-early June) is adequate, but slightly below optimum. The average temperatures (16-18 °C) during the tuber formation stage are in the optimum range (11-20 °C). The average temperatures (18-15 °C) during the tuber growth phase (July-September) are in the desirable range (<22 °C). Parker (2010) states that the best yield and the highest amount of starch in Russet Burbank potatoes are obtained when nighttime soil temperatures are 16°C and daytime soil temperatures are 18°C. Potatoes with higher starch contents are judged to be of higher quality than those with less starch. Indeed, inadequate starch content may lead to potatoes being rejected for certain processing purposes.

Temperatures at all the stations listed in **Table 2** fall within the most favourable range for potato production. During the warmer than average summers, the temperatures are undoubtedly slightly above the optimum for the warmer locations (Alliston, Dashwood,

	Elevation (m)	Annual Precipitation (cm)	May-Sept Precipitation (cm)	Monthly Temperature (°C)					
					May	June	July	Aug	Sept
Monticello	482	99.1	44.9	Daily (average)	11.2	15.8	18.6	17.7	13.4
				Daily (maximum)	16.4	21	23.6	22.7	17.9
Proton Station	480	108.3	44.6	Daily (average)	10.9	15.4	17.8	17	12.9
				Daily (maximum)	16.6	21	23.5	22.6	18.1
Grand Valley	465	91.7	44.2	Daily (average)	11.6	15.8	18.8	17.7	13.4
				Daily (maximum)	17.7	21.9	24.9	23.5	18.7
Orangeville	412	89.2	41.7	Daily (average)	11.8	16.5	19.1	18.3	14
				Daily (maximum)	17.8	22.5	25	24	19.3
Guelph	328	88.3	43.2	Daily (average)	12.3	16.9	19.7	18.2	14.1
				Daily (maximum)	18.5	23.3	25.9	24.5	19.8
Woodstock	282	83.7	44.6	Daily (average)	13.2	18.2	20.4	19.6	15.4
				Daily (maximum)	19.2	24.1	26.4	25.3	20.9
Dashwood	253	98.5	44.2	Daily (average)	13.3	18.3	20.5	19.7	16
				Daily (maximum)	18.6	23.5	25.7	24.7	20.8
Delhi	231	85.7	43.7	Daily (average)	13.2	18.4	20.9	20	15.6
				Daily (maximum)	19.3	24.4	27	25.7	20.9
Alliston	221	84.7	41.5	Daily (average)	13.3	18	20.8	19.7	15.4
				Daily (maximum)	19.4	24	26.8	25.5	20.9
Kingsville	200	89.4	38.9	Daily (average)	14.2	19.5	22.1	21.2.	17.3
				Daily (maximum)	18.9	23.8	26.5	25.5	21.6

[**Table 2**: Agroclimatic conditions (1971-2000 averages) for Dufferin County and other southern Ontario locations (from Environment Canada).]

Delhi, Guelph, Kingsville and Woodstock). The approximately 2°C that the temperatures at the high elevation Dufferin stations are below those of the other stations at lower elevation provide a buffer that favours Dufferin as a potato growing area. In the context of potential global warming, this temperature decrease with increasing elevation means that the Dufferin region will remain a more favourable agroclimate for potato production than the other regions of southwestern and south central Ontario.

In summary, the agroclimate of highlands of Dufferin County is in the optimum range for potato production. While varieties of grain corn and oilseed crops have been developed that can mature in the highlands of Dufferin, the cooler conditions limit their yield relative to that attained in the warmer parts of the province; for these other crops, the Dufferin agroclimate is sub-optimum.

The Landscape Setting

The landscape in which the Honeywood soils have developed, as already indicated, consists of a superficial deposit of silt overlying till that ranges from sandy loam to clay loam, which in turn overlies Amabel limestone. The Amabel limestone bedrock underlies till deposits in a N-S band across Southern Ontario, to the west of the Niagara Escarpment, from the Bruce Peninsula to Hamilton (Geological Survey of Canada, 1969).

The following interpretation of the Wisconsinan deglaciation history of the Dufferin area is summarized from the account of Chapman and Putnam (1966). During deglaciation, land was first exposed in southwestern Ontario when a split between the ice flowing from the lobes occupying Lake Huron and Lake Ontario occurred near Orangeville. As these ice fronts retreated toward their respective basins, an area of land from roughly London to the northern parts of Dufferin County became ice free. The retreat of the Lake Huron lobe allowed the ice lobe occupying Georgian Bay to re-advance over the northern part of Dufferin County to a location between Grand Valley and Shelburne that is marked by a faint end moraine. Subsequent retreat of this ice front toward Georgian Bay re-exposed the land surface of the parts of northern Dufferin County that lie above the Niagara Escarpment. During this final melting of the thinning ice that covered this landscape, a number of eskers were formed in the channels of subglacial streams, and a 'sprinkling' of erratic boulders, that had been picked up by the ice as it advanced over more northerly rocks, were left on the clay loam till surface. These boulders were mostly of igneous or metamorphic character, indicating that they originated from Canadian Shield.

On the areas where the Honeywood catena soils are present, these boulders were subsequently buried by silt and fine sand that was eroded by wind action from barren land surfaces upwind. These wind-blown materials, known as loess, are common on the Dundalk till plain, which includes most of Dufferin County that lies west of the Niagara escarpment and adjacent parts of Grey and Wellington Counties. Gwyn (1975) supports the interpretation that the silt and fine sand mantle is of windblown origin. Over the western parts of the Dundalk till plain, the loess deposits are less than two feet thick but they increase to four to six feet deep in the Shelburne-Horning's Mills-Honeywood region. The region of Honeywood silt loam in the area surrounding Honeywood, Redickville and Horning's Mills constitutes the thickest and largest contiguous area of loess landscape, and soils developed on loess, in Eastern Canada. It constitutes an area of potential provincial and national heritage interest. The nearest, larger contiguous areas of loess landscapes are in areas of the mid-western United States that lie to the south of the maximum advance of the Wisconsinan Glaciation.

Synthesis

The outcomes of this analysis are that:

1. the Honeywood soil in Dufferin County is a Class 1 soil for potato production.
2. the agroclimatic conditions in the highlands of Dufferin County are the best match in southwestern Ontario to the optimum conditions for potato production;
3. the combination of the soil and agroclimatic conditions and the properties of the Honeywood soil, together, combine to make the areas of Honeywood soil in Dufferin County uniquely suited, and 'special' for production of potatoes;
4. the combination of the soil and the agroclimate, while satisfactory for the production of corn and oilseed crops, are suboptimum for those purposes; these crops produce higher yields in warmer regions of Ontario;
5. under scenarios of global warming, the highlands of Dufferin County will increase their advantage for potato production relative to warmer regions of Ontario;
6. the landscape of the areas of Dufferin County, particularly the area occupied by the Honeywood soil in northeastern Melancthon, constitutes a landscape that is unique within eastern Canada; it is an area of potential heritage interest;
7. the scientific evidence strongly supports the local knowledge of the area's farmers by confirming that the Honeywood soil, on level to gently sloping band in Dufferin County, is exceptional in the context of potato growing.

Rehabilitation

If the Highland's Quarry proceeds in the proposed location, I understand that there must be a commitment to rehabilitate the area for agriculture once extraction is complete. Among the problems related to rehabilitation are: a) the lower elevation of the quarry bottom and its being surrounded by 'walls' (probably with trees planted for erosion control and aesthetic reasons) will lead to poor air drainage with consequent higher summer temperatures and the presence of 'frost pockets' an agroclimatic change in spring and fall that will shorten the growing season ; b) the configuration of the quarry as proposed has a very large perimeter which decreases substantially the area that can be returned to agricultural production by rehabilitation; the larger than necessary perimeter also increases the total area outside the boundary of the quarry that is likely to experience a lowering of the water table, with its resultant effects; c) the overburden on top of the Amabel limestone is dominantly carbonate-containing glacial till, with the loess in which the Honeywood soil has developed constituting a thin surface cover; any mixing of the glacial till with the overlying loess will result in a deterioration of the soil quality relative to that of the in-place Honeywood silt loam; d) it is arrogance to believe that the agricultural production capacity of the affected area of what is widely agreed, and scientifically verifiable, to be one of the best soils in Ontario (and the best for potato production) can be regenerated on the smaller area represented by the quarry bottom. There are probably other reasons rehabilitation to original quality is not attainable. A major factor of the challenge of rehabilitation to original productivity is that almost all of the proposed quarry area consists of Class 1 land with superior and unique characteristics for potato production, only a very small proportion is topographically or otherwise not in the Class one category.

Regarding identification of less prime areas where extraction could occur without the same impact, I am not being facile to suggest that identification of almost any other area underlain by Amabel Limestone would have less agricultural impact than would occur in siting the quarry on either of the northern or southern parcels of Honeywood silt loam.

Conclusion

In conclusion, it is my opinion as a soils scientist that the area outlined in **Figure 1** satisfies all of the criteria required to qualify as a specialty crop area as defined in the Provincial Policy Statement. Further, it is my opinion that rehabilitation of this area to a similar level of productivity after aggregate extraction would not be possible.

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