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to

AGRICULTURAL WATERSHED STUDIES (PHASE II - DETAILED STUDIES)
TASK GROUP C - (Canadian) - PLUARG - IJC
on
PROJECT SEVEN (7)

SOIL SURVEY OF SIX AGRICULTURAL SUBWATERSHEDS IN SOUTHWESTERN ONTARIO

CONTRIBUTION NUMBERS: LAND RESOURCE RESEARCH INSTITUTE #24
ONTARIO INSTITUTE OF PEDOLOGY# 1

Project Leader: C.J. Acton
Research Associates: G.T. Patterson
C.G. Heath

Ontario Institute of Pedology
University of Guelph
Guelph, Ontario.
N1G 2W1

DISCLAIMER

The study discussed in this document was carried out as part of the efforts of the Pollution from Land Use Activities Reference Group, an organization of the International Joint Commission, established under the Canada - U.S. Great Lakes Water Quality Agreement of 1972. Findings and conclusions are those of the authors and do not necessarily reflect the views of the Reference Group or its recommendation to the. Commission.

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SUMMARY

The primary objective of this project was to inventory the soils of the six agricultural subwatersheds chosen for detailed study (AG-1,3,4,5,10 and 13). The inventoried soils were interpreted for their agricultural capability and for their inherent ability to transmit pollutants to both surface water and groundwater systems. Samples of representative soils were collected for PLUARG investigators involved in Projects 8, 9, 10 and 11.

The soil inventory was compiled at a scale of l:25,000 (semi-detailed level) using NTS topographic sheets as base maps. Mapping units consisted of complexes of soil series. Other information conveyed by the mapping symbol included slope and stoniness phases. Analytical data collected for the major soil series include particle size distribution, organic matter content, pH, calcium carbonate equivalent, exchangeable cations, Na-pyrophosphate and oxalate extractions. Selected soils were analysed for clay-sized mineralogy, cation exchange capacity, shrink-swell properties, compaction characteristics, Atterburg Limits, vane shear strength, infiltration rate and hydraulic conductivity.

The extent of soil series in each subwatershed as estimated in this project was compared to estimates obtained from reconnaissance soil survey reports published on a county basis. In general, the extent of poorly drained soils was much greater on the more detailed maps produced for this report. In addition, some changes in the description of soil parent materials were effected. Most changes were due to the greater level of detail allowed by a larger scale and by the system of mapping soil complexes rather than 'pure' units. Other changes were related to revisions in the definition of some soil series.

Certain patterns of soil characteristics and land use became evident in the subwatersheds (Table 1). The range in soil textures is from sandy and coarse loamy in AG-13 to very fine clayey in AG-10. Slopes are generally less than 5% and,with the exceptions of AG-3 and 10, are long and smooth. The only significant occurrences of Class 3 land for agriculture occur in AG-10 and AG-13. The remainder of the areas inventoried are Class 1 or 2 for agriculture. Land use ranges from cash cropping (AG-1) to dominantly hay and pasture (AG-10). AG-13 has significant areas devoted to horticultural crops. All of the areas, with the possible exception of AG-13, have negligible interference from urban encroachment.

TABLE 1: Soil and Land Use Characteristics of the Subwatersheds

Subwatershed	Dominant Particle Size Class	Dominant Natural Soil Drainage	Dominant Slope	Dominant Pollutant Transfer Potential	Dominant Agricultural Capability*	Land Use
AG-1 (Big Creek)	fine clayey	poorly drained	<2%	V	2W	soybeans, corn, small grains; no livestock
AG-3 (Little Ausable)	fine clayey	even distribution mod. well, imp. and poorly drained	<5%	I, V	1, 2T, 2W	corn, small grains, white beans, hay and pasture; dairy beef
AC-4 (Canagagigue)	fine clayey	even distribution mod. well, imp. and poorly drained	<5%	I, V	1,2W	small grains, hay corn; dairy
AG-5 (Holiday Creek)	fine loamy	even distribution well, imp. and poorly drained	<5%	II, IV, V	1,2W	corn, hay and pasture, small grains; dairy, hogs
AG-10 (Smithville Creek) or North Creek	fine and very fine clayey	imperfectly and poorly drained	<5%	I, V	2D,3W	hay and pasture, corn, small grains; hogs, poultry, dairy, beef
AC-13 (Hillman Creek)	sandy and coarse loamy	imperfectly and poorly drained	<2%	II, III, V	1,2F,3W	corn, vegetables and fruit, soybeans, tobacco; few livestock; some rural non-farm strip development

* Environment Canada, 1972

When considered for pollutant transfer potential, all of the subwatersheds include significant proportions of Group V soils. Group V soils occur mainly in association with Group I soils in AG-3,4 and 10; with Group II and IV in AG-5; and with Groups II and III in AG-13. AG-1 consists of almost exclusively Group V soils.

The rate of water entry into the surface horizon of the major soils was measured using three techniques. These were the permeameter method which measures saturated hydraulic conductivity (KS), the falling head double ring method which measures steady state infiltration (SSI_F) and the constant head double ring method which also measures steady state infiltration (SSI_K). Measurements at a total of sixteen sites, repeated three times per year failed to detect significant seasonal changes in the rate of water entry into most soils. Soils with similar rates of water entry were grouped using a modified version of Sheffe's Multiple Range Test. All groups tended to be vaguely defined with large overlaps between groups.

Correlation and regression techniques were used to measure the relationship between the three methods of measurement. K_S was found to be related to SSI_F on a nearly 1:1 basis. SSI_K tended to be consistently lower than KS values. SSI_K and SSI_F were poorly correlated,

Correlation and regression were also used to describe the influence of selected soil parameters on the rate of water entry into soils. KS and SSI_F showed significant correlation with bulk density and porosity measurements. SSI_K was best correlated with bulk density, textural and structural properties but none of the parameters chosen showed a statistically significant relationship.

INTRODUCTION

In order to understand the effects of various land uses, researchers must be aware of the physical and chemical characteristics of the land itself. Soil survey involves the classification, definition and delineation of the various soils in an area, thus allowing prediction of soil behaviour patterns under given sets of conditions. Thus, the objectives of this project were:

(i) To provide a soils :Inventory of the detailed subwatersheds (AG-1, 3,4,5,10 and 13) at a scale of 1:25,000. The inventory includes a measure of seasonal and spatial soil variability with emphasis on water transmission properties.

(ii) To interpret the soils inventoried for their agricultural capability and their ability to transfer pollutants to surface water and to groundwater.

(iii) To provide samples of major soil series for input to Projects 8, 9, 10 and 11.

The locations of the six agricultural subwatersheds chosen for detailed study are shown in Fig.1l. Study areas were chosen to represent agricultural land use patterns common to the dominant soil/climate zones of Southwestern Ontario. A more detailed analysis of how the selection process operated is provided by Coote et al (1974). Four of the subwatersheds (AG-1,3,4,10) consist mainly of fine clayey soils. Agricultural land use in these areas ranges from dominantly hay and pasture in AG-10 to strictly cash cropping of corn and soybeans in AG-1. One subwatershed, AG-5, consists mainly of fine loamy soils. The dominant land use in AG-5 is the production of corn, hay, pasture and small grains to support a dairy industry. The coarse loamy and sandy soils of AG-13 are used mainly for corn, vegetables, fruits and soybean production.

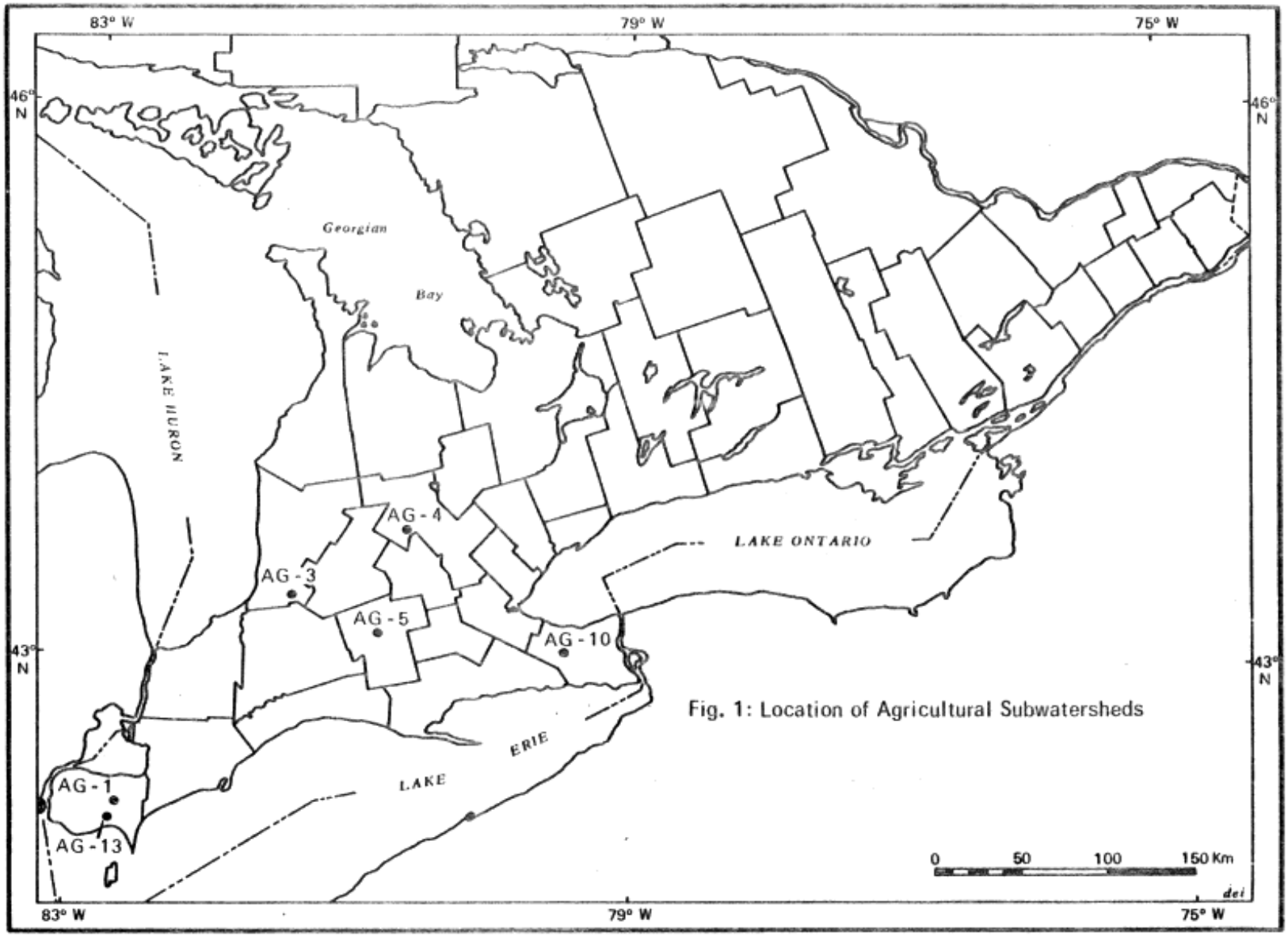

Fig. 1: Location of Agricultural Subwatersheds

METHODS

SOIL MAPPING METHODS

Recent black and white aerial photographs at 4 inches to 1 mile (1:15,840) were obtained to provide stereoscopic coverage for each subwatershed. A soil legend was established for each area through the identification of landforms on the photographs and by studying soil landform relationship in the field. Landscape units were delineated on the photographs and transferred to 1:25,000 base maps. Field work involved the identification of the texture and mode of origin of soil parent material to a depth of one meter, profile horizonation, natural drainage, slope, stoniness and erosion classes for each unit. This information was coded on the CanSIS (Canadian Soil Information System) format. Observation frequency was approximately one site per 40 hectares.

A three digit numbering system was devised for the soil series identified in each subwatershed. It must be emphasized that the numbering system is unique to this study - the system is not correlated to the Soil Names File for Canada or any other previously existing system. Soil series numbers were assigned sequentially as the survey progressed from one subwatershed to the next. Within subwatersheds, an attempt was made to assign numbers beginning with the coarsest material and progressing to the finest textured material. Land types were identified by letter rather than numbers. The first two digits include information pertaining to the parent material of the series and the last digit indicates the natural soil drainage. Where-ever possible, these numbered series have been correlated with the named series used in the reconnaissance soil reports available on a county basis.

The notation used on the soil maps allows two soil series to comprise one cartographic unit. Estimates of the extent of each series within the unit are incorporated into the notation. Whether the presence of one or two soil series is indicated for a unit, it can be assumed that 20% of the area is occupied by inclusions. The nature of the inclusions can often be inferred by knowing the relationship between the two dominant series in the unit. For example, a landscape may be dominated by a well drained soil on the upper slopes and by a poorly drained soil in the depressions. Inclusions in this case are inferred to be imperfectly drained soils on the lower slopes.

The base used for the soil maps of the subwatersheds was a 1:25,000 NTS topographic

sheet wherever possible. In two instances, AG-3 and AG-4 (Little Ausable and Canagagigue), 1:50,000 sheets were the largest scale available. These were enlarged photographically to 1:25,000 so the enlargements lack the detailed base information provided on the larger scale maps. None of the final soil maps include contour information because it was felt that this would clutter the maps to the point where information would be very difficult to extract.

The minimum area that can be accurately outlined on any map is approximately 40mm^2. At a scale of 1:25,000, this represents 2.5 ha on the ground. However, very few delineations of this size can appear on a map due to the difficulty of inserting map edits into the outlined area. Thus, the smallest area consistently outlined on the soil maps of the subwatersheds is approximately 100mm^2 or slightly over 7 ha. Soil boundaries themselves can be placed accurately to ±1mm on the base map if the field boundary is distinct. At a scale of 1:25,000, the accuracy on the ground is ±25m. Where the field boundary between soils is less distinct, the margin for error would have to be increased.

SOIL SAMPLING METHODS

During the course of establishing a legend and the actual mapping of each subwatershed, the variability and extent of each series was noted. Upon completion of the mapping procedure, sample sites were selected to reflect the heterogeneity of each major series. In some instances where samples were required immediately or where sites were required for ongoing measurements, the procedure was necessarily reversed ie site selection took place before mapping. In those cases, information previously available for the area was studied and sites were chosen after a brief field tour.

Soils were sampled from pits dug by hand and measuring approximately 90 x 130 cm and deep enough to reach relatively unaltered parent material, usually 60 to 110 cm below the surface. Detailed or semi-detailed CanSIS forms were used to record the description of the profile thus exposed.

Soil samples were collected by working from the lowermost to the uppermost horizons to minimize contamination. Plastic tools were used where the samples were to be analysed for heavy metal content. In cases where the soil was dry and compacted, samples were loosened with a spade and metal contact areas removed before bagging the sample. At detailed sites, six or more 'point' samples of approximately 1500g each were collected from every continuous horizon; at semi-detailed sites, two samples per horizon were taken. These samples were split in the laboratory by breaking each sample into a plastic tray, thoroughly mixing, dividing into four and combining diagonally opposite quarters. One half of the original sample was retained in Guelph for routine analysis and the other half was sent to the Soil Research Institute in Ottawa for analysis of heavy metal content. Blind replicates were produced by collecting 3000g at one point, mixing the entire sample thoroughly and dividing into four samples, two retained in Guelph and two sent to Ottawa. It was indicated to the laboratories involved that the replicates originated at separate sites. The results were compared after analysis was complete.

Samples for nitrogen transformation studies and for organic matter characterization were composites of the Ap horizon at detailed sites.

FIELD MEASUREMENT METHODS

Infiltration measurements were made using the double ring method described by Bertrand (1965). The inner ring was 30.5 cm in diameter and 30 cm high. The outer ring was 50.8 cm in diameter and 15 cm high. Both rings were made from 0.64 cm (¼") rolled steel. The bottom edges of the rings were sharpened to facilitate driving them into the soil.

When in use, the cylinders were driven 5 cm into the surface horizon. Excess vegetation was removed and the soil adjacent to the inner ring was firmly tamped to prevent rapid water movement in the zone disturbed by inserting the ring.

The falling head apparatus used in 1975 proved to be inadequate because of the inability to obtain a reliable value for steady state infiltration. The constant head apparatus used in 1976 maintained a 5 cm head of water in the inner ring. Water intake was measured at ten minute intervals until a constant rate was attained.

Saturated hydraulic conductivity was measured using the air-entry permeameter (AEP) described by Topp and Binns (1976). The AEP was used wherever possible at sites where infiltration measurements were made. Because the AEP depends upon a tensiometer to detect the arrival of a wetting front, measurements could not be made in wet soils. Effectiveness was also limited when cracks appeared in extremely dry soils.

Vane shear values were obtained by using the methods outlined in the American Society for Testing and Materials (1975).

ANALYTICAL METHODS

Methods used follow techniques described in the 'Manual on Soil Sampling and Methods of Analysis' prepared by Subcommittee (of Canada Soil Survey Committee) on Methods of Analysis. Particle size analysis was performed using the pipette method. Pretreatments involved removing fractions >2mm by sieving, destroying organic matter with 27.5% hydrogen peroxide and dispersing with a mixture of calgon and sodium carbonate. Carbonates and oxides were not removed from the samples. The calcium carbonate equivalent was calculated from weight loss after treatment with 6N hydrochloric acid. Soil pH was measured using calomel and glass electrodes on 1:1 soil pastes prepared with water and with calcium chloride. The exchangeable calcium, magnesium, and potassium values were determined by extraction with neutral normal sodium acetate. Total phosphorus was determined using extraction with 0.5M sodium bicarbonate. Organic matter content was determined by the Walkley-Black method of wet oxidation. Iron, alumina and manganese contents were determined by acid ammonium oxalate extraction. Organic complexes of iron and alumina were measured using sodium pyrophosphate extraction. Cation exchange capacity was determined by the sodium acetate method. Bulk density measurements were obtained using the core technique.

Mineralogy of the clay--sized fraction was estimated by the semi-quantitative method outlined by Wall and Wilding (1976). Clays were Mg-saturated and given the following treatments; ethylene glycolated, air dry, 400C for two hours and 550C for two hours. A General Electric SPG-6 diffractometer with a copper X-ray tube was used to obtain diffraction patterns.

Engineering properties of selected soils were measured according to the American Society for Testing and Materials (1975). Measurements included Atterburg Limits, maximum wet density, maximum dry density,-optimum moisture content, California bearing ratio swelling, potential volume change, shrinkage ratio and shrinkage limit.

METHODS OF INTERPRETATION

Capability for Agriculture

Capability classes for agriculture were assigned to each soil series according to the methods outlined by Environment Canada (1972). The capability system is an interpretative grouping of soils based on the kind and degree of limitation that soil conditions impose on mechanized agriculture. Each soil is placed in one of seven capability classes depending on the degree of the most severe limitation(s) of that soil for production of common field crops. One or more of thirteen subclasses are used to indicate the kind of limitation for all classes except Class 1. Class 1 soils are assumed to have no limitations.

Pollutant Transfer Potential

An interpretative grouping was devised to classify soils according to their inherent ability to transmit pollutants to surface water and groundwater systems (Table 2). The system is based on the premise that thick, well drained, medium textured soils on gently topography are best able to absorb or renovate most pollutants that may be added to them. As infiltration rates decrease (due to steep slopes or impermeable soils, for example), the danger of transmitting pollutants to surface water systems increases. Shallowness to pervious bedrock and rapid permeability increase the danger of pollutant transfer to groundwater systems. Poor soil drainage decreases the capacity of a soil to renovate most pollutants. Poorly drained soils occupy landscape positions which receive runoff and/or seepage from upslope positions. The excess water may subsequently discharge into streams or percolate into groundwater potentially transporting pollutants into either system.

TABLE 2 - Soil Potential For Pollutant Transfer (adapted from pp. 14-15 Agricultural Watershed Study Plan, Canada, 1974-75)

	Profile Texture	Slope	Drainage Class
GROUP I -	SOILS WITH HIGH POTENTIAL FOR CONTRIBUTION TO SURFACE WATER SYSTEMS AND LOW POTENTIAL FOR CONTRIBUTION TO GROUNDWATER		
Ia	Fine textured profiles, low infiltration rate		
	clay, clay loam, silty clay, silty clay loam	all	good, imperfect
Ib	Medium textured profiles, low infiltration rates		
	loams, silt loams	>5%	good
	loams, silt loams	all	good, imperfect
Ic	Coarse textured profiles		
	sands, thin sandy loam over clay	>2%	good, imperfect
Id	Organic profiles	all	
Ie	Miscellaneous land types		
	bottom land, alluvium escarpment		
GROUP II -	SOILS WITH MODERATE POTENTIAL FOR CONTRIBUTION TO BOTH SURFACE AND GROUNDWATER		
Ib	Medium textured profiles		
	loam, silt loam, loam over gravel	<5%	mainly imperfect
GROUP III -	SOILS WITH HIGH POTENTIAL FOR CONTRIBUTION TO GROUNDWATER AND LOW POTENTIAL FOR CONTRIBUTION TO SURFACE WATER		
IIIb	Medium textured profiles		
	fine sandy loam, gravelly loam, loam over gravel	all	mainly poor
IIIc	Coarse textured profiles		
	deep sand, sandy loam, sand or sandy loam over gravel	all	mainly poor
IIIf	Shallow soils over pervious bedrock	all	mainly poor

TABLE 2 cont'd

GROUP IV -	SOILS WITH LOW POTENTIAL FOR CONTRIBUTION TO BOTH SURFACE WATER AND GROUNDWATER		
IVb	Medium textured profiles		
	loam, silt loam, loam over gravel	<5%	good
IVc	Coarse textured profiles		
	thick sand or sandy loam over clay	<2%	all
GROUP V -	SOILS WITH HIGH POTENTIAL FOR CONTRIBUTION TO BOTH SURFACE WATER AND GROUNDWATER		
Va	Fine textured profiles		
	clay, clay loam, silty clay, silty clay loam	all	poor
Vb	Medium textured profiles		
	loam, silt loam	all	poor
Ve	Rock outcrop		

FINDINGS

SUBWATERSHED AG-1 (BIG CREEK)

Subwatershed AG-l consists of 5080 ha drained by the headwaters of the west branch of Big Creek. Big Creek is a tributary of the Thames River which flows into Lake St. Clair. The study area is entirely in Essex County approximately 10 km north of Leamington (Fig 2).

AG-1 is representative of a system of farming common in most of Essex County and portions of Lambton and Kent counties. Cash cropping of corn, soybeans and wheat is very common and hog production is the most important livestock operation.

The soils of the area are dominantly fine textured although thin sandy and gravelly overburdens occur intermittently. Due to poor natural drainage, the CLI agricultural capability is mainly 2W.

Bedrock Geology

Subwatershed AG-l is underlain by the Dundee Formation which was laid down in the Devonian Period (Ontario Division of Mines, 1972). This formation consists of light brown limestone with some chert and usually with basal sandstone (Martini, Protz and Chesworth, 1970). No bedrock exposures were found within the study area.

Surficial Geology

Subwatershed AG-1 lies in the St. Clair Clay Plain which is essentially a till plain that has been smoothed by lake action (Chapman and Putnam, 1966). The till contains quantities of black shale presumably originating from the black shale bedrock formation occurring to the north of the region.

Vagners (1972) describes four surficial materials within the watershed boundary. The dominant of these is a fine textured glacial till of Wisconsin age. Discontinuous layers of glaciofluvial gravelly sand occur over the till mainly in the south-western portion of the watershed. To the south-east, there are glaciolacustrine medium sandy overburdens existing in discontinuous fashion over the till. The fourth and very minor material is glaciolacustrine sand that has been reworked by wind action into dunes.

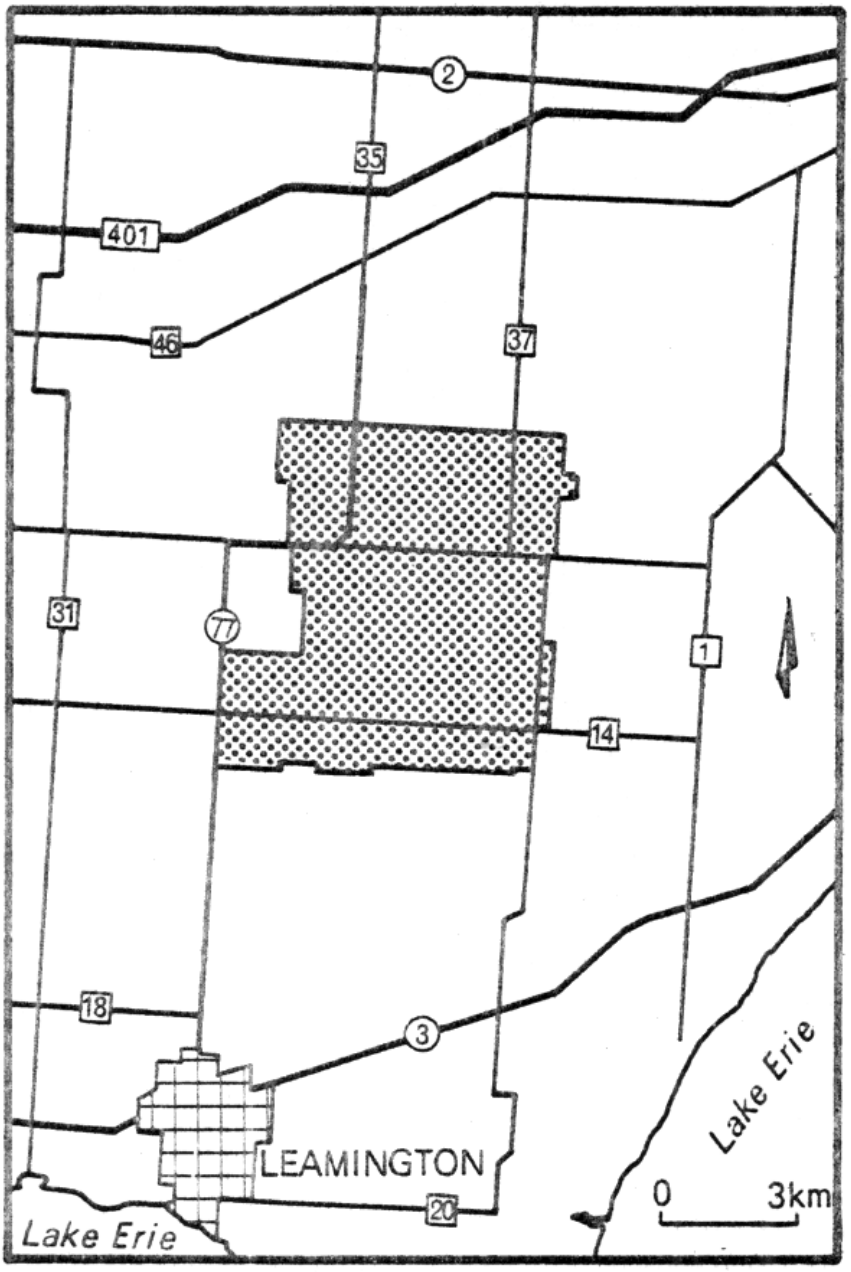

Fig. 2: Location of AG-1

TABLE 3 - Soil Series of AC-1

Particle Size Class or Land Type	Soil Series or Land Type	Slope and Stoniness Phases	Extent		.Pollutant Transfer Potential	Agricultural Capability
			Hectares	%		
sandy	153	CO	5	<1	III	2^{F}_{M}
coarse loamy over clayey	165	BO	270	5	IV	2_{F}
fine clayey with	175	B_1	370	7	I	2_{D}
	175	B_2	5	<1	I	2_{D}
thin (<50 cm)coarse	175g	B_1	15	<1	I	2_{D}
loamy overburdens in						
	176	AO	4140	81	V	2_{W}
the sandy(s)and	176s	AO	70	1	V	2_{W}
gravelly(g) phases	176s	BO	145	3	V	2_{W}
	176	B_1	10	<1	V	2_{W}
stream course complex	SC	--	50	1	I	variable

Distribution of Soils in AG-1

Table 3 shows the particle size classes, slope and stoniness phases, aereal extent and pollutant transfer potential of the soil series recognized in AG-1. Approximately 80% of the area consists of Series 176 which developed from poorly drained fine clayey parent materials on nearly level topography.

Table 4 is a summary of the pollutant transfer potential of the soils in AG-1. Over 80% of the area is occupied by Group V soils which have a high potential to contribute to both surface and groundwater systems.

TABLE 4 - Pollutant Transfer Potential of the Soils of AG-1

Group	Hectares	%
I	440	9
III	5	<1
IV	270	5
V	4365	86
Total	5080	100

Generalized Soil Series Descriptions

Series 153

Series 153 includes all well drained soils in Subwatershed AG-1. They have developed from glaciolacustrine medium sand that has been reworked by wind action. These soils occur on 2-5% slopes and are restricted to a small area near the centre of the watershed. At the subgroup level, Series 153 is classified as an Orthic Melanie Brunisol. Some imperfectly drained soils on similar parent material occur as inclusions on the lower portions of slopes occupied by Series 153.

The profile is fine sand to loamy fine sand throughout with very little evidence of mottling. The surface horizon (Ap) is 15-20 cm thick with generally less than 3% organic matter. Underlying the Ap is one or more Bm horizons that show no evidence of translocated clay or other accumulations of weathering products. The calcareous Ck horizon occurs at a depth of 80-100 cm.

Series 153 does not correlate well with previous series established in Essex County. Series 153 soils are Croup III soils when considered for pollutant transfer potential. They have high potential to contribute to groundwater and low potential to contribute to surface water.

Series 165

Series 165 includes all imperfectly drained soils that have developed in 50-100 cm glaciolacustrine fine to medium sandy loam over fine textured glacial till. They occur on simple 0.5-2% slopes in association with Series 176 and 176s. Series 165 is classified as a Gleyed Orthic Gray Brown Luvisol at the subgroup level.

The surface horizon (Ap) is 25-30 cm thick and is generally sandy loam to loamy sand in texture. Underlying the Ap is a discontinuous Aegj horizon. This layer is leached of clay and sesquioxides and contains yellowish brown mottles which are indicative of seasonally high watertables. The next horizon, the Btgj, contains weathering products accumulated from the A horizons. It is generally sandy loam to sandy clay loam in texture. Its thickness is dependent mainly on the depth of overburden because the calcareous II Ckgj horizon usually coincides with the till contact. The till is similar to the parent material of Series 175 and 176.

Series 165 is similar to Series 125 established in Hillman Creek Sub-watershed (AG-13). Both are similar to the Berrien Series as previously established in Essex County except for depth criteria. The Berrien Series had sandy material of 90-180 cm thickness (3 - 6 ft) over clay till.

Series 165 soils are placed in Group IV when considered for pollutant transfer potential. These soils have low potential to contribute to both surface water and groundwater.

Series 175 and 175g

Series 175 soils have developed from calcareous clay and silty clay glacial till in imperfectly drained locations. Up to 50 cm of gravelly sandy loam glaciofluvial overburden occurs in the gravelly phase. These soils occur on simple 0.5 - 2% slopes mainly in association with Series 176. At the subgroup level, Series 175 is a Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) of Series 175 is clay loam in texture generally having a clay content of 30 - 35%. In the gravelly phase, the Ap is gravelly sandy loam to sandy loam in texture. Underlying the Ap horizon is an eluviated zone subject to seasonally high water tables (Aegj). This horizon is discontinuous and is generally loam in texture. In the gravelly phase, the texture may be gravelly loamy sand, depending upon where the till contact occurs.

Beneath the Aegj is the Btgj horizon, a zone of clay accumulation. The texture may be gravelly sandy clay in the gravelly phase (175g) but is most often clay. There is some tendency for the structure of the B to be prismatic but this development is weak and the prisms easily break into a fine to medium angular blocky arrangement. The solum depth is 45 -55 cm.

Series 175 is similar to the Perth Series as established in Essex County. The gravelly phase was not previously recognized.

Series 175 and 175g are Group I soils when considered for pollutant transfer potential. They have high potential to contribute to surface water systems and low potential to contribute to groundwater systems.

Series 176, 176s and 176g

Series 176 is made up of poorly drained soils that have developed from calcareous clay and silty clay glacial till. These soils occur on nearly level landscapes in association with Series 175 and to a lesser extent with Series 165. The sandy phase, 176s, has a glaciolacustrine sandy loam overburden up to 50 cm in thickness. As this overburden becomes deeper, the drainage usually improves, so Series 176s grades into Series 165. The gravelly phase, 175g, has a glaciofluvial gravelly sandy loam overburden up to 50 cm in thickness. Series 176, 176s and 176g are classified

as Orthic Humic Gleysols at the subgroup level.

In woodlots, the surface horizon (Ah) of Series 176 is 5 - 10 cm in thickness, generally clay loam in texture and very high in organic matter. Cultivation has mixed the Ah and the upper portion of the B horizon to form the Ap horizon. The Ap is 15 - 20 cm in thickness, clay loam to clay in texture (35 - 40% clay, 35 - 40% silt) and contains 3 - 4% organic matter. The underlying B horizon can be divided into two horizons, the Bg_1 and the Bg_2, as the mottles become coarser and more extensive with depth. Both B horizons contain 40 - 50% clay and have strong medium subangular blocky structure. When the soil is dry, cracks several millimeters in width develop that in many cases form continuous channels from the soil surface to the Ckg horizon 90-120 cm below the surface.

The sandy and gravelly phases of Series 176 have sandy loam and gravelly sandy loam Ap horizons, respectively, that are 20-25 cm in thickness. The upper portion of the B horizons in these phases may or may not be similar in texture to their A horizons. Clay textures are always encountered below a depth of 50 cm. Where the overburden is present, the structure of the B horizon tends to be coarser and somewhat less well developed. Depth to free carbonates(Ckg horizon) is generally 70-90 cm.

Series 176 is similar to Series 136 in Subwatershed 13 and to the Brookston Series as established in Essex County. The sandy and gravelly phases were not previously recognized. Series 176, 176s and 176g are Group V soils when considered for pollutant transfer potential. These soils have high potential to contribute to both surface water and groundwater systems.

Stream Course Complex

This is a Miscellaneous Land Type used to describe the floodplain and streambanks of presently active stream courses. The floodplains are generally very narrow in AG-1 and consist of waterworked tills and alluvium laid down mainly during spring flooding. The banks consist of fine-textured glacial till. Streams in AG-1 have been greatly altered by artificial deeping and straightening in an attempt to improve drainage. Spoil from these activities has often been spread on adjacent fields.

Stream course units are Group I when considered for pollutant transfer potential. They have high potential to contribute to surface water and low potential to contribute to groundwater systems.

SUBWATERSHED AG-3 (LITTLE AUSABLE RIVER)

Subwatershed AG-3 consists of the area drained by the headwaters of the Little Ausable River which eventually flows into Lake Huron via the Ausable River. The study area lies between the towns of Exeter and Lucan (Fig 3), approximately 35 km north of London.

AG-3 is 6200 ha in size and is representative of farming practices common to Southern Huron County and portions of Lambton, Middlesex, Perth and Oxford Counties. Agriculture in this region is centered mainly on corn, soybean and small grains production with a high density of cattle and hogs.

The soils of the area are derived mainly from moderately fine textured glacial till with shallow silty overburdens in many cases. Isolated areas of outwash sands and gravels also occur. The agricultural capability of the soils throughout the region is generally CLI Class 1 or 2. Slight limitations due to wetness (CLI Class 2_W) or topography (CLI Class 2_T, some 3_T) are frequently encountered.

Bedrock Geology

Subwatershed AG-3 is underlain by the Dundee Formation of the Middle Devonian Period (Ontario Division of Mines, 1972). The formation consists of light brown limestone with some chert and usually with basal sandstone (Martini, Protz and Chesworth, 1970). No bedrock exposures occur within the study area.

Surficial Geology

AG-3 lies mainly within the physiographic region known as the Horseshoe Moraines (Chapman and Putnam, 1966). In the general vicinity of the study area, this region consists of two or sometimes three north-south trending ridges that resemble end moraines resulting from small fluctuations in ice movement (Karrow, et al, 1974). The major surficial deposit in the area is a calcareous pale brown fine textured "subaqueous till" (Hoffman, et al, 1952). This is a glacial till of dominantly limestone origin that has subsequently been modified by the presence of lacustrine waters. Karrow attempted to separate the areas of relatively unmodified till from deposits of glaciolacustrine massive silt. The silty deposits have no shoreline, suggesting sedimentation in slow moving silt laden water. These deposits are intricately associated with till knolls so that inclusions of till are common in the glaciolacustrine units and vice versa.

Minor deposits include deltaic outwash sand and gravel in an old spillway channel in the north-eastern sector of the subwatershed. Shallow deposits of well humified organic material overlie the sand directly to the south of the outwash. Further south, still in the same spillway, the sand is covered by a thick (>1m) layer of laminated silt and very fine sand.

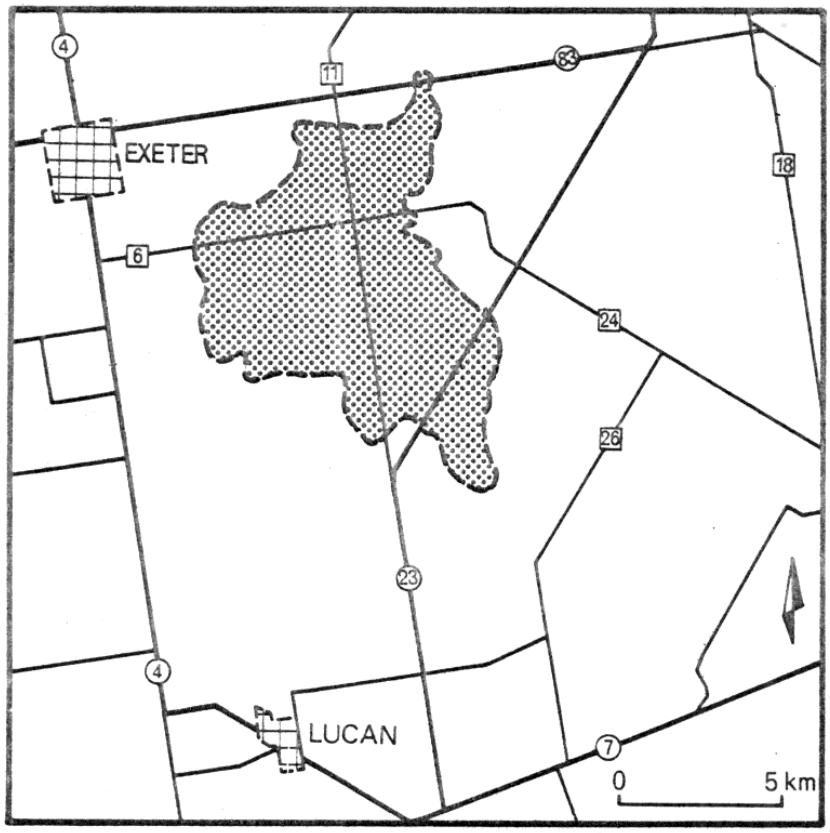

Fig. 3: Location of AG-3

TABLE 5 - Soil Series of AG-3

Particle Size Class or Land Type	Soil Series or Land Type	Slope Stoniness Phases	Extent		Pollutant Transfer Potential	Agricultural Capability
			Hectares	%		
loamy-skeletal	183	C0	40	1	IV	2^{F}_{M}
	185	C0	10	<1	II	2F
fine loamy over sandy	195	b1	130	2	II	1
coarse silty	206	A0	345	6	I	3_W
fine clayey over loamy	216	A0	90	1	V	2_W
fine loamy over	223	C0	5	<1	IV	1
clayey		c0	25	<1	IV	2_T
fine silty	225	B0	15	<1	II	1
		b0	370	6	II	1
fine clayey	226	B0	85	1	V	2_W
		b0	5	<1	V	2_W
	234	c1	1185	19	I	2_T
		c2	5	<1	I	2^{E}_{T}
		C1	205	3	I	1
		D1	30	<1	I	2_T
	235	B1	70	1	I	1
		b1	1335	22	I	1
		C1	130	2	I	1
		D1	10	<1	I	2T
	236	B1	20	<1	V	2_W
		b1	1890	30	V	2_W
organic	247	A0	5	<1	I	unclassified
stream course complex	SC	--	170	3	I	variable
disturbed land	DL	--	25	<1	III	unclassified

Distribution of Soils in AG-3

Table 5 shows the particle size class, slope and stoniness phases, areal extent and the pollutant transfer potential of the soil series recognized in AG-3. Nearly 80% of the soils have developed from clayey parent material. Over half of the soils are Group I for pollutant transfer and one third are in Group V (Table 6). Group I soils have high potential to contribute to surface water systems and low potential to contribute to groundwater. Group V soils have high potential to contri- bute to both surface and groundwater systems.

TABLE 6 - Pollutant Transfer Potential of the Soils of AG-3

Group	Hectares	% of Area
I	3490	56
II	525	8
III	25	1
IV	70	1
V	2090	34
Total	6200	100

Generalized Soil Series Descriptions

Series 183

Series 183 is made up of well drained soils that have developed in 15-50 cm of glaciolacustrine silt loam overlying calcareous glaciofluvial gravel and gravelly sand. In localized areas, the silt loam overburden has been severely eroded, exposing the gravelly material beneath. Series 183 occurs on 2-5% slopes in the northwesterly portion of AG-3, mainly in association with Series 185. Gravel pits, termed "Disturbed Land" in this report, are common on both series. At the subgroup level, Series 183 is classified as an Orthic Gray Brown Luvisol.

The surface horizon (Ap) is silt loam in texture and 20-25 cm thick. This is underlain by an eluviated horizon (Ae), also silt loam, that is irregular and discontinuous in form. In the deeper phases, the Ae horizon may show some color differentiation, recognizable as Ae_1 and Ae_2 subhorizons. Consequently these soils are classified as Brunisolic Gray Brown Luvisols.

Underlying the Ae horizon is a zone of clay accumulation, the Bt horizon. It is generally 10-15 cm in thickness and gravelly sandy clay loam in texture. Due to its tonguing nature, the depth to free carbonates, or the Ck horizon, ranges from 60 to more than 100 cm over short distances. Series 183 is similar to the Burford Series as established in Huron County.

Series 183 is a Group IV soils when considered for pollutant transfer potential. These soils have low potential to transmit pollutants to both surface water and groundwater.

Series 185

Series 185 is comprised of imperfectly drained soils which have developed from 15-50 cm of glaciolacustrine silt loam overlying calcareous gravel and gravelly sand. Series 185 occurs mainly in association with Series 183 and grades into Series 195 as the overburden becomes deeper and more till-like in appearance. At the subgroup level, Series 185 is classified as Gleyed Orthic Gray Brown Luvisol.

The horizon sequence of Series 185 is very similar to that of Series 183, namely silt loam textured Ap and Aegj horizons overlying a gravelly sandy clay loam Btgj, with a gravelly sand textured Ckgj. However, the sequence is not as strongly developed under imperfectly drained conditions, so the B horizon is sometimes gravelly sandy loam in texture and has a discontinuous nature. Rusty colored mottles are present in all horizons below the Ap in Series 185, indicating seasonally high watertables. The southern-most portions of the 185 mapping unit have lower gravel contents than the northern-most units.

Series 185 is comparable to the Brisbane Series as established in Huron County. These soils are Group II when considered for their pollutant transfer potential. They have moderate potential to contribute to both surface water and groundwater.

Series 195

The soils of Series 195 are imperfectly drained and have developed in 50 - 100 cm of silty clay loam glacial till overlying glaciofluvial gravelly sand. They occur in association with poorly drained soils derived from similar parent material and grade into Series 185 as the overburden becomes thinner and less till-like in appearance. At the subgroup level, Series 195 is a Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) of Series 195 is silt loam in texture and generally 20 - 25 cm in thickness. Underlying the Ap horizon is an eluviated layer that is mottled. The mottles are indicative of periodic reducing conditions due to seasonally high watertables. The notation used in this case is Aegj.

The weathering products that have been leached from the upper profile have accumulated in the B horizon, making it silty clay loam to clay loam in texture. The depth to free carbonates generally coincides with the depth to the gravelly substratum, generally 70 - 80 cm beneath the surface.

Series 195 does not correlate well with any previously named soil series.

Series 195 is a Group II soil when considered for pollutant transfer potential. These soils have moderate potential to contribute to both surface water and groundwater systems.

Series 206

Series 206 soils are poorly drained and have developed in calcareous laminated silt and very fine sand of glaciofluvial origin. These soils occur on level terrain along the westerly branch of the Little Ausable. The area is bounded on the east and west by north-south trending morainic ridges and as a result, is a zone of groundwater discharge. Because of the net upward movement of water through the soil profile, the profile is moderately calcareous throughout. At the subgroup level, Series 206 is classified as anorthic Humic Gleysol-Carbonated Phase.

The surface horizon is silt loam in texture and 20 - 25 cm thick. In most cases the surface is moderately calcareous although in areas of local microrelief some of the carbonates have been leached resulting in weak calcareousness. The surface horizon is described by the notation Apk.

Underlying the surface are two horizons (Bgk_1 and Bgk_2) that are strongly mottled and also moderately calcareous. The mottles become coarser and more abundant with depth and structural development is weaker in the lower B horizon. The Ckg horizon occurs at 70-90 cm below the surface and is grayish brown in color. It has abundant coarse mottles and a platy structure that is inherented from the mode of deposition rather than as a result of soil forming processes.

On the basis of. similarity in parent material and drainage, Series 206 resembles the Colwood Series. However, the Colwood Series does not have a calcareous solum.

Series 206 is a Group I soil when considered for pollution transfer potential. Group I soils have low potential to contribute to groundwater but high potential to contribute to surface water systems.

Series 216

Series 216 soils are poorly drained and have developed from calcareous silty clay loam of glaciolacustrine origin. These soils occur alone on nearly level topography and as inclusions in the 226 and 236 mapping units. At the subgroup level, the taxonomic classification of Series 216 is Orthic Humic Gleysol.

The surface horizon (Ap) is silt loam to silty clay loam in texture and 20-25 cm thick. The underlying Bg horizon has a similar texture and contains many coarse mottles which are indicative of reducing conditions due to high watertables for significant portions of the year. The structure of Series 216 soils is not as strongly developed as that of Series 236, a poorly drained soil derived from glacial till.

The depth to relatively unaltered parent material (Ckg horizon) is 4560 cm, which makes Series 216 soils shallower than either of Series 226 or 236. The Ckg horizon is generally silty clay loam in texture, but may be silt loam locally. Bedding planes in this material are very weakly expressed.

Series 216 does not correlate well with any previously established series in Huron County.

Series 216 soils are Group V when considered for pollutant transfer potential. These soils have high potential for contributions to both surface water and groundwater.

Series 223

Series 223 is made up of well drained soils developed from 50-100 cm of glaciolacustrine silt loam over silty clay loam glacial till. These soils occur in association with Series 225 on simple 2-5%

slopes and with Series 216 and 236 on complex 2-5% slopes. They also occur as inclusions in the 234 mapping units. At the subgroup level, the classification of Series 223 is Orthic Gray Brown Luvisol.

The surface horizon (Ap) of these soils is generally silt loam in texture and 15-20 cm thick. The high silt content combined with sloping topography make these soils very susceptible to water erosion. The Ap horizon is underlain by a discontinuous layer of eluviation, the Ae horizon. Under virgin conditions, the Ae can be divided into two sub-horizons because of secondary Brunisolic processes. However, in most cases the upper Ae has been incorporated into the plow layer.

Weathering products, mainly clay, that have been leached from tha A horizon have accumulated in the underlying Bt horizon. The Bt horizon has usually developed entirely in the glaciolacustrine overburden, so it is stonefree and generally silty clay loam to silty clay in texture. Structural development in Series 223 appears not to be as strongly developed as in Series 234. The depth to free carbonates is 55-70 cm and often coincides with the underlying glacial till or II Ck horizon. A gravelly layer is often present at the till contact. Occasionally, relatively unweathered glaciolacustrine material can be found above the till.

Series 223 has no previously established counterpart in Huron County. It does, however, correlate with the Bennington Series as established in Oxford County.

Series 223 is a Group IV soil when considered for pollutant transfer potential. These soils have low potential to contribute to either groundwater or surface water systems.

Series 225

The soils of Series 225 are imperfectly drained and have developed from 50-100 cm of glaciolacustrine silt loam overlying silty clay loam glacial till. These soils occur on the lower portions of 2-5% slopes in association with Series 223 and on the upper portions of 0.5-2% slopes in association with Series 216, 226 and 236. Series 225 also occurs as inclusions in 235 mapping units. At the subgroup level, the taxonomic classification of Series 225 is Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) is generally silt loam in texture and 15-20 cm thick. Underlying the Ap is a zone of eluviation that is subject to periodic reducing conditions. The notation used here is Aegj. This horizon ranges in thickness from 0-30 cm and is silt loam in texture.

The next underlying horizon is the Btgj. It is a zone of clay accumulation that is silty clay loam in texture with a strong subangular blocky structure. This grades into a zone of transition (BC horizon)

that has a lower clay content, less strongly developed structure and is weakly calcareous. A discontinuous layer of relatively unaltered parent material (Ckgj) is often present between the B horizon and the underlying silty clay loam till.

Series 225 is similar to the Tavistock Series.

Series 225 is a Group II soil when considered for pollutant transfer potential. Group II soils have moderate potential to contribute to both surface water and groundwater systems.

Series 226

Series 226 soils are poorly drained and have developed from 50-100 cm of glaciolacustrine silty clay loam overlying silty clay loam glacial till. These soils occur in depressional areas in association with Series 234, 235 and 225. They also occur as inclusions in the 236 mapping unit. At the subgroup level, Series 226 is classified as an Orthic Humic Gleysol.

The surface (Ap) horizon is 20-25 cm thick and ranges in texture from silty clay loam to silt loam. The organic matter content is higher than for Series 223 or 225 because of the slower rate of decomposition under poorly drained conditions. The underlying B horizon is strongly mottled, which is indicative of reducing conditions due to high watertables for significant portions of the year. This horizon can be divided into two subhorizons because the mottles become coarser and more extensive with depth. Structural development becomes weaker and coarser with depth.

There is often a gravelly layer between the Bg horizon and the underlying glacial till. When this layer is present, the till does not show characteristic gley colours presumably because the water table is perched above this zone.

Series 226 is comparable to the Maplewood Series.

Series 226 is a Group V soil when considered for pollutant transfer potential. These soils have high potential to contribute to both groundwater and surface water systems.

Series 234

Series 234 includes all moderately well drained soils that have developed from calcareous yellowish brown glacial till that ranges in texture from silty clay loam to clay loam. Soils with glaciofluvial silt loam overburdens up to 50 cm in thickness were also included in this series. Series 234 occurs mainly on the upper and intermediate portions of 2-5% slopes. Where the topography is simple, Series 235 occurs on the lower slopes but in complex topography Series 216, 226 and 236 occur in the poorly drained depressions. At the subgroup level, the classification of Series 234 is Orthic Gray Brown Luvisol.

The surface horizon (Ap) ranges from silt loam to silty clay loam in texture and is commonly 15-20 cm thick. In many cases it was noted that the Ap horizon was weakly calcareous. 0ne possible explanation for this is that the plow layer has extended to the Ck horizon where erosion has removed much of the surface. However, another point to consider is that the parent material is highly calcareous. Calcium carbonate equivalents in the Ck horizon often reached 50%. This, together with the clayey texture of the material would result in shallow profile development. Occasional incorporation of calcareous material into the plow layer would occur even without severe erosion under these circumstances.

Underlying the surface horizon is a zone of eluviation, the Ae horizon. Under woodlot conditions, the Ae horizon is 10-30 cm thick, but under cultivated conditions most of the Ae has been incorporated into the plow layer. The Bt horizon, a zone of clay accumulation underlies the Ae.

This horizon is brown in color and has a strong blocky structure. Relatively unaltered parent material (Ck horizon) occurs at 50-65 cm beneath the surface.

Series 234 correlates well with the Huron Series as established in Huron County.

Series 234 is a Group I soil when considered for pollutant transfer potential. These soils have a high potential for contribution to surface water but a low potential for contribution to groundwater systems.

Series 235

Series 235 developed from clay loam and silty clay loam glacial till under imperfectly drained conditions. These soils occur on the lower portions of 2-5% slopes in association with Series 234 and on the upper and intermediate portions of 0.5-2% slopes in association with Series 216, 226 and 236. Inclusions of Series 235 soils occur in Series 225 mapping units. At the subgroup level the taxonomic classification of Series 235 is Gleyed Orthic Gray Brown Luvisol.

The sequence and texture of horizons of Series 235 is similar to that of Series 234. However, Series 234 usually has 2-3% more organic matter in the Ap horizon and all horizons below the Ap are mottled, indicating seasonally high water tables. The Ae-Bt sequence is not as strongly developed in the imperfectly drained soil. The depth to relatively unaltered parent material is 45-55 cm for Series 235, 50-65 cm for Series 2 34 .

Series 235 correlates well with the Perth Series as established in Huron County.

Series 235 is a Group I soil when considered for pollutant transfer potential. These soils have a high potential to contribute to surface water and a low potential to contribute to groundwater.

Series 236

Series 236 is comprised of poorly drained soils that have developed from silty clay loam till. These soils occur in depressional areas associated with Series 234, 235 and sometimes 225. Common inclusions in the 236 mapping unit are Series 216 and 226. The classification of Series 236 at the subgroup level is Orthic Humic Gleysol.

The surface horizon (Ap) is silty clay loam to silt loam in texture and generally 25-30 cm thick. In some instances, particularly in association with Series 234 on complex topography, colluvium has accumulated to a 60-70 cm thickness on the surface of Series 236 soils.

The B horizon of Series 236 soils is highly mottled indicating that watertables are high in these soils for significant portions of the year. The mottles become coarser and more extensive with depth. Structure also becomes coarser with depth so the Bg horizon can usually be split into two subhorizons, the Bg_1 and Bg_2. The depth to relatively unaltered parent material, the Ckg horizon, is usually 80-100 cm.

Series 236 is comparable to the Brookston Series as established in Huron County.

Series 236 are considered to be Group V soils when considered for their potential to transfer pollutants. These soils have high potential to contribute to both surface water and groundwater systems.

Series 247

Series 247 includes very poorly drained soils composed of well humified organic material overlying calcareous brown gravelly sand. These soils have a very limited extent in AG-3. They occur mainly in the spillway channel in the western portion of the subwatershed at the interface of Series 195 and 206. At the subgroup level, the classification of Series 247 is Terric Humisol.

The upper tier of Series 247 is composed of 30-75 cm of well decomposed organic material derived from mosses, sedges, trees and shrubs. Few woody fragments are present. The middle tier is composed of 10-60 cm marl composed mainly of animal shells and some diatomaceious earth. This is underlain by calcareous brown gravelly sand. The depth to the sand is rarely more than 160 cm from the surface.

Soils similar to Series 247 were called 'Muck' in the Huron County Soils Report.

Series 247 is a Group I soil when considered for pollutant transfer potential. These soils have low potential to contribute to groundwater and high potential to contribute to surface water.

Stream Course Complex (SC)

This is a Miscellaneous Land Type used to describe the floodplain and streambanks of presently active stream courses. The floodplain consists of waterworked tills and recent deposits of alluvium laid down mainly during spring flooding. The streambanks usually consist of silty clay loam glacial till.

Stream course complex units are Group I when considered for pollutant transfer potential. They have high potential to contribute to surface water and low potential to contribute to groundwater.

Disturbed Land (DL)

This is a Miscellaneous Land Type used to describe areas greatly disturbed by man's activities. In Watershed 3, the term has been applied solely to gravel pits and the spoil resulting from aggregate extraction activities. These areas are considered to be Group III when considered for pollutant transfer potential. They have high potential to contribute to groundwater systems and low potential to contribute to surface water systems.

SUBWATERSHED AG-4 (CANAGAGIGUE)

Subwatershed AG-4 consists of the area drained by the headwaters of the west branch of Canagagigue Creek. Canagagigue Creek rises in Wellington County and drains into the Grand River which flows into Lake Erie at Port Dover. The study area of 1860 ha is located approximately 35 km northwest of Guelph in the Fergus - Elora - Elmira vicinity (Fig 4).

AG-4 is typical of a system of farming common to the central portion of Wellington County and portions of Waterloo, Perth and Oxford Counties. Small grains, hay and silage corn are the most commonly grown crops. These crops are used mainly to support dairy and hog industries.

The soils of the region are similar to those in AG-3: moderately fine textured soils developed from glacial till. Medium textured tills are also common in AG-4. The CLI capability rating for the soils in the region is generally very high. Slight limitations due to wetness (2_W) and topography (2_T, some 3_T) are commonly encountered.

Bedrock Geology

Subwatershed AG-4 is underlain by the Salina Formation which was laid down during the Silurian Period (Ontario Division of Mines, 1972). This formation consists of dolomite interbedded with gypsum, anhydrite and salt (Martini, Protz and Chesworth, 1970) existing in a north-south trending belt across Southwestern 0ntario. The formation does not outcrop within the study area.

Surficial Geology

AG-4 lies within an arm of the Stratford Till Plain which extends from Northern Middlesex County through Perth and Wellington to Dufferin County. The major surficial deposit throughout the Plain is a brown calcareous fine clayey glacial till derived from limestone bedrock and previously deposited varved clays of the Lake Huron Basin (Chapman and Putnam, 1966). However, coarse loamy tills associated with the Guelph Drumlin Field are also found within the subwatershed boundaries (Hoffman and Wicklund, 1963; Karrow, 1971). The coarser tills outcrop near the mouth of the watershed and can be seen exposed in lower portions of streambanks throughout the area. Their proximity to the surface also accounts for lower clay contents than might have been anticipated for some of the soils series in the area.

Minor surface deposits in the vicinity include well humified organic material and shallow pond and lake deposits.

Distribution of Soils in AG-4

Table 7 shows the particle size classes, slope and stoniness phases, areal extent and pollutant transfer potential of the soil series recognized in AG-4.

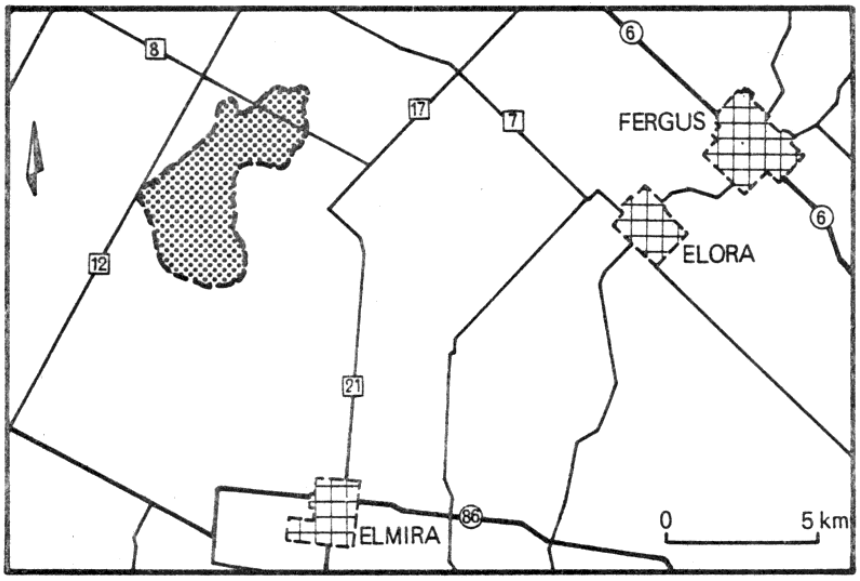

Fig. 4: Location of AG-4

TABLE 7 - Soil Series of AG-4

Particle Size Class or Land Type	Soil Series or Land Type	Slope Stoniness Phases	Extent		Pollutant Transfer Potential	Agricultural Capability
			Hectares	%		
fine loamy over clayey	005	B0	5	<1	II	1
fine loamy	013	B_1	<5	<1	IV	1
		C_1	25	1	IV	1
	015	B_1	<5	<1	II	1
		C_1	10	<1	II	1
fine clayey	024	B_1	5	1	I	1
		C_1	430	23	I	1
fine silty	025	B_1	515	28	I	1
		C_1	265	14	I	1
fine clayey	026	B_1	415	22	V	2_W
clayey, marl	037	A0	50	3	I	unclassified
stream course complex	SC	--	135	7	I	variable
disturbed land	DL	--	5	<1	III	unclassified

The dominant parent material in the area is a fine clayey till, slightly over half of which is imperfectly drained with the remainder divided almost equally between moderately well and poorly drained. Since the moderately well and imperfectly drained clayey materials both fall into Group I, this Group is dominant in AG-4. Most of the remainder is Group V. This information is summarized in Table 8.

TABLE 8 - Pollutant Transfer Potential of the Soils of AG-4

Group	Hectares	%
I	1405	76
II	15	1
IV	25	1
V	415	22
Total	1860	100

Generalized Soil Series Descriptions

Series 005

Series 005 soils occupy a minor portion of Subwatershed AG-4, being restricted to a small area south and west of Goldstone. These soils have developed in imperfectly drained laminated silt and very fine sand overlying waterworked clay loam till. The overburden ranges in thickness from 50-100 cm. Series 005 occurs with other drainage members of the same catena and grades into Series 025 as the overburden becomes shallow. At the subgroup level, Series 005 is classified as a Gleyed Orthic Gray Brown Luvisol.

Above the till contact, the profile is dominantly silt loam in texture. The sand fraction is mainly in the fine to very fine size range and the total sand content is less than 30%. Due to restricted water movement, there is minimal pedogenic clay accumulation in the B horizon and the surface (Ap) is relatively thick and dark. At the till contact, the clay content increases to 25-35%, compared to 10-20% found in the upper profile.

Series 005 is roughly comparable to the Tuscola Series as described in the Soil Survey of Wellington County. However, the Tuscola soils do not have a till contact within 100 cm of the surface.

Series 005 is considered to be a Group II soil when considered for pollutant transfer potential. These soils have moderate potential to contribute to both surface water and ground water.

Series 013

Series 013 soils have developed from loam to silt loam glacial till which has a high content of siltstone. The weathered siltstone imparts a yellowish cast to the entire profile. Series 013 soils are well drained and occupy the upper and intermediate portions of 0.5-5% slopes in the area immediately adjacent to the mouth of AG-4. At the subgroup level, Series 013 is classified as a Brunisolic Gray Brown Luvisol. It occurs mainly in association with Series 015.

The clay content of the surface horizon (Ap) can be expected to range between 15 and 20%, slightly lower than that of Series 024. The silt content is high, generally above 50% so the surface horizon is most commonly silt loam in texture.

The eluviated horizon (Ae) underlying the surface can be subdivided into two subhorizons (Ae_1 and Ae_2) based on color differences which reflect differences in strength of weathering. The color contrast is most evident when the profile is dry: the Ae_1 horizon is brown while the Ae_2 is light gray in color. Both the Ae and Ae_2 are discontinuous mainly as a result of cultivation. Both are silt loam in texture.

Beneath the Ae horizon is a zone of clay accumulation (Bt). The clay content of the Bt ranges between 25 and 35% with a silt content between 40 and 55%. Thus, the dominant texture is clay loam although loam and silty loam textures may be encountered.

The calcareous parent material (Ck horizon) most commonly occurs at a depth of 65-80 cm. It is yellowish brown in color and loam to silt loam in texture.

Series 013 is comparable to the Harriston Series as established in Wellington County. It is distinguished from the Guelph Series mainly on the basis of its higher silt content.

Series 013 soils are placed in Group IV when considered for pollutant transfer potential. They have low potential to contribute to both surface water and groundwater.

Series 015

These soils are imperfectly drained and have developed from loam and silt loam glacial till similar to that which have rise to Series 013 in other landscape positions. Series 015 occupies the lower portions of gently sloping topography in association with Series 013. The taxonomic classifications of Series 015 at the subgroup level is Gleyed Brunisolic Gray Brown Luvisol.

Series 015 soils are subject to seasonally high water tables. Mottling in all horizons below the surface (Ap) horizon is evidence of this condition. The Ap horizon of Series 015 is somewhat darker than that of Series 013 because of the slower rate of organic matter decomposition under imperfectly drained conditions. Both Series 015 and 013 have silt loam surface horizons that contain slightly less clay than any of Series 024, 025 and 026.

The zone of clay accumulation (Btgj) is not as pronounced in Series 015 as in Series 013 because of restricted water movement in the imperfectly drained soil. The depth to parent material averages 50-70 cm in Series 015, slightly less than in Series 013.

Series 015 is comparable to the Listowel Series as established in Wellington County. The Listowel Series is distinguished from the London Series on the basis of a higher silt content in the former.

Series 015 soils are Group II when considered for pollutant transfer potential. They have moderate potential to transmit pollutants to both surface water and groundwater.

Series 024

Series 024 includes all moderately well drained soils which have developed in clay loam and silty clay loam glacial till. These soils are found on the upper and intermediate portions of gentle slopes and always occur in association with Series 025. The taxonomic classification of Series 024 at the subgroup level is Orthic Gray Brown Luvisol.

The silt content of the surface horizon (Ap) ranges from 45-50%, while the clay content lies between 20 and 30%. The dominant surface texture is thus silt loam, but clay loam and silty clay loam textures may also be encountered.

Underlying the Ap horizon is an eluviated layer (Ae). Under virgin conditions this horizon grades from brown at its upper surface (Ae_1) to a lighter color at its base (Ae_2). Under cultivated conditions, however the Ae_1 and portions of the Ae_2 have been incorporated into the plow layer.

The Bt horizon of Series 024 soils show substantial amounts of illuvial clay. Their textures range from silty clay loam to clay and silty clay (35-50% clay, 35-50% silt). Strong subangular blocky structure is characteristic of the Series 024B horizon, so the solum is moderately pervious to air and water under unsaturated conditions. When the soil is thoroughly wetted, however, the cracks and pores may swell and close making the soil relatively impervious. The solum thickness ranges from 40-60 cm.

Series 024 is comparable to the Huron Series as established in Wellington County.

Series 024 soils are Group I when considered for pollutant transfer potential. These soils have high potential to contribute to surface water systems and low potential to contribute to groundwater systems.

Series 025

Series 025 includes all imperfectly drained soils that have developed in clay loam and silty clay loam glacial till. Similar parent material gives rise to Series 024 under better drainage conditions. Series 025 is found in middle and lower portions of gently sloping topography in association with Series 024 and on the upper portions of very gently sloping topography in association with Series 026. The taxonomic classification of Series 025 is Gleyed Orthic Gray Brown Luvisol.

As a result of the slower rate of organic matter decomposition under imperfectly drained conditions, Series 025 has a darker surface horizon (Ap) than does Series 024. The dominant surface texture of the two series is the same, namely silt loam.

The eluviated horizon of Series 025 is mottled which reflects the reducing conditions brought about by seasonally high water tables. Due to restricted water movement, this horizon is less well developed than the Ae horizon of Series 024.

Clay is the main accumulation product in the B horizon of Series 025. However, the clay increase is generally less than that encountered in Series 024 and the solum depth is shallower, ranging from 35 to 45 cm for the imperfectly drained soil.

Series 025 is generally comparable to the Perth Series as established in Wellington County, although Series 025 generally has clay contents approaching the lower limits allowable for the parent material of Perth soils.

Series 025 soils are Group I soils when considered for pollutant transfer potential. They have high potential for contribution to surface water and low potential for contribution to groundwater.

Series 026

Series 026 soils have developed from clay loam and silty clay loam glacial till under poor drainage conditions. These soils occur on very gently sloping topography in association with Series 025 and on nearly level to depressional topography in association with soils developed from shallow lacustrine deposits, as yet unnamed. Series 026 is classified as an Orthic Humic Gleysol at the subgroup level.

Series 026 soils have a dark surface horizon, commonly 20-35 cm thick. Clay loam and silty clay loam are the dominant surface textures. The fine textures of Series 026 surface horizons is due, in part, to the accumulation of colluvium from upper slopes occupied by Series 024 and 025. Another contributing factor is that the basins now occupied by Series 026 were probably the site of shallow ponding during periglacial times. The slow rate of organic matter decomposition under poorly drained conditions also contributes to the formation of a thick, dark surface horizon.

The underlying B horizon shows strong evidence of prolonged periods of reducing conditions, but little evidence of clay translocation. The clay films present on the strongly formed peds are thought to be pressure oriented rather than as a result of clay movement downward in the profile. The B horizon can be divided into two or more layers on the basis of intensity and extent of mottling. Clay loam and clay are the dominant textures encountered. The solum depth is extremely variable ranging from 50 to over 100 cm.

Series 026 is comparable to the Brookston Series as established in Wellington County.

However, Series 026 has a thicker solum and a higher clay content than described for Brookston soils in Wellington County.

Series 026 is a Group V soil when considered for pollutant transfer potential. These soils have high potential for contribution to both surface water and groundwater systems.

Series 037

The soils of Series 037 are found in very poorly drained depressions formerly occupied by shallow lakes or ponds. These soils are composed of well humified organic matter derived from sedges, mosses, leaf litter and some coarse woody fragments from trees. The organic deposit is 40-160 cm deep and is underlain by 10-25 cm of marl. Underlying the marl is calcareous clay and silty clay material of glaciolacustrine origin. The taxonomic classification of Series 037 is Terric Humisol.

Inclusions in the 037 mapping unit are Typic Humisols (humic material greater than 160 cm deep). Limno Humisols (more than 5 cm of marl underlying humic material where mineral material is greater than 160 cm beneath the surface) and peaty Gleysols (40 cm humic material over mineral soil). None of these inclusions have been given series numbers in this survey because of their limited areal extent in the study area.

Previous surveys used the term "muck" to describe all organic deposits.

Series 037 and its associates are considered to be Group I soils. They have high potential for contribution to surface water systems and low potential for contributions to groundwater.

Stream Course Complex (SC)

This is a Miscellaneous Land Type that occurs on landscapes associated with presently active stream courses. Both the floodplain and streambanks are included in the same mapping unit. The streambanks consist of glacial till similar to that of adjacent mapping units except where different till deposits are exposed when the stream is deeply incised. The floodplains consist of waterworked till and alluvium laid down mainly during spring flooding. Disturbed land associated with channel widening and straightening can also be found within this unit. None of the individual members of this complex were separated on the map because of scale limitations and because all members are interpreted similarly for pollutant transfer potential. All fall into Group I; high potential for contribution to surface water and low potential for contribution to groundwater.

Disturbed Land (DL)

This is a Miscellaneous Land Type composed of areas greatly modified by man's activities. In AG-4 this designation was used for gravel pits only.

SUBWATERSHED AG-5 (HOLIDAY CREEK) *

Subwatershed AG-5 is drained by the headwaters of Holiday Creek, a tributary of the Thames River which flows into Lake St. Clair. The study area is 3000 ha in size. It is located in Oxford County, 15 km south of Stratford near the town of Embro (Fig 5).

AG-5 represents the type of agriculture commonly found in central Oxford and central Waterloo Counties, as well as smaller portions of Middlesex, Elgin and Oxford Counties. Dairy farming is the most important agricultural activity in these areas. The main crops grown are corn for silage, small grains, hay and pasture. Hog production is also important in the region. Some soybeans and vegetables are grown.

The soils in AG-5 are derived mainly from medium textured glacial till. Isolated areas of coarse textured outwash occur in association with the till. Small areas of organic soils occur in very poorly drained depressions. In general, the soils of the region are CLI capability Class 1 for agriculture but significant amounts of soils with slight wetness limitations (Class 2_W) occur.

Bedrock Geology

AG-5 is underlain by the Detroit River Formation (Ontario Division of Mines). This formation was laid down during the Devonian Period and consists of dolomite and limestone with some gypsum and chert (Martini, Protz and Chesworth). There are no outcroppings of bedrock within the study area.

Surficial Geology

Subwatershed AG-5 lies within an area known as the 0xford Till Plain which is a drumlinized upland surface with the major soil parent material being a pale brown loam till (Chapman and Putnam, 1966). Cowan (1975) informally names this material 'Zorra till'. He describes it as a 'stony silt or sandy silt till' which tends to become clayey near its base. During the course of the present study, this 'Zorra till' was found to be the most common surficial deposit in AG-5. The clay content usually ranged between 9 and 15% with the silt content in the range of 40-50%. The gravel content was usually 10-20%. In certain instances, particularly between the elevations of 1070-1100 feet above sea level, there was a tendency for the till to become darker brown in color and finer in texture although the clay content never exceeded 25%.

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* This creek has no official name. For convenience in this report, the stream has been called 'Holiday Creek' after the small settlement of Holiday located near the mouth of the subwatershed.

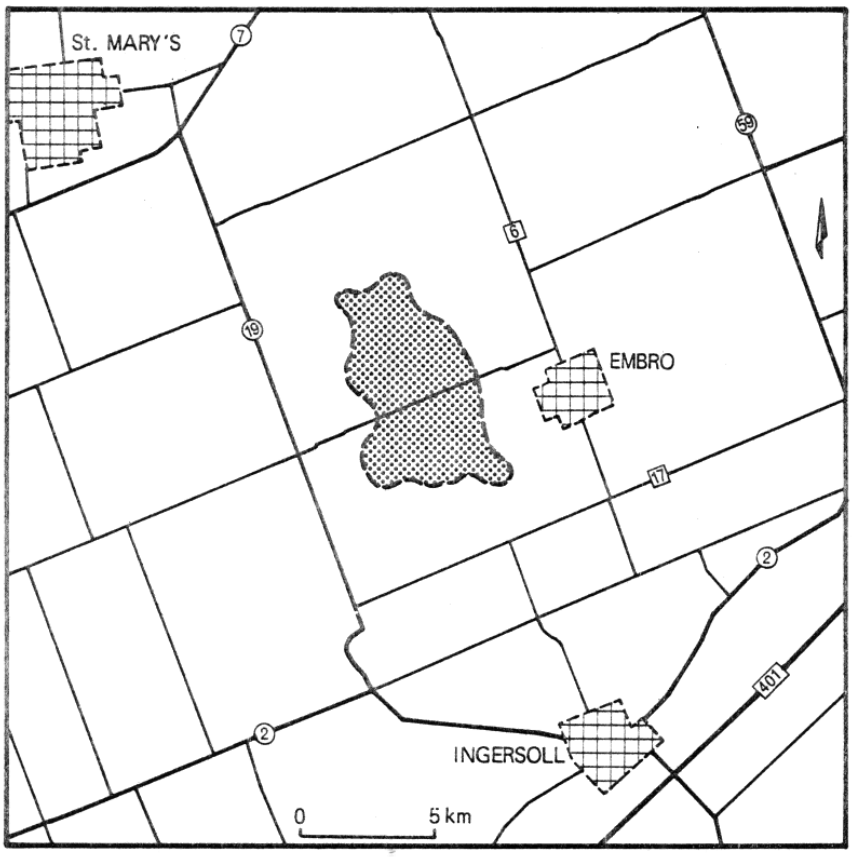

Fig. 5: Location of AG-5

TABLE 9 - Soil Series of AG-5

Particle Size Class or Land Type	Soil Series/ Land Type	Slope/stoniness Phases	Extent		Pollutant Transfer Potential	Agriculture Capability
			Hectares	%		
coarse loamy	043	C1	720	24	IV	1
fine loamy	045	B1	790	26	II	1
		Cl	210	7	II	1
fine loamy	046	B1	700	23	V	2_W
fine loamy	053	C1	145	5	V	1
		d2	30	1	I	3_T
	055	B1	50	2	II	1
	056	B1	45	2	III	3_W
Humic clayey	067	A0	20	1	I	unclassified
	077	A0	60	2	I	unclassified
stream course complex	SC	--	230	8	I	variable

Glaciofluvial silt loam overburdens were previously reported for many of the soils in AG-5 (Wicklund and Richards, 1961). During the course of present investigations, it was found that his overburden rarely exceeded 50 cm, so no alluvium over till series were established in the legend for this report.

Minor surficial deposits in AG-5 include well humified organic soils and shallow till deposits over outwash gravelly sandy loam and medium sand.

Distribution of Soils in AG-5

Table 9 is a summary of the particle size classes, slope and stoniness phases, areal extent and pollutant transfer potential of the soil series recognized in AG-5. Coarse loamy tills were found to occupy approximately 80% of the area with the remainder divided among coarse loamy over sandy material, organic soils and stream course complexes. These soils were fairly evenly distributed among pollutant transfer groups II, IV and V with minor representation in Groups I and III. Table 10 illustrates this more clearly.

TABLE 10 - Pollutant Transfer Potential of the Soils of AG-5

Group	Hectares	%
I	340	11
II	1050	35
III	45	2
IV	720	24
V	845	28
Total	3000	100

Generalized Soil Series Descriptions

Series 043

Series 043 soils have developed from calcareous pale brown to brown loam till on well drained sites. These soils occur mainly on the upper and intermediate portions of gentle slopes in association with Series 045. Series 043 grades into Series 053 where outwash gravelly fine sandy loam occurs at depth in the profile. The taxonomic classification of Series 043 at the subgroup level is Orthic Gray Brown Luvisol, indicating that a Bt horizon is present. In some cases, however, there is insufficient clay in the B horizon to meet the requirements of Bt. Thus, another associate of Series 043 is an unnamed series which is classified at the subgroup level as a Degraded Melanic Brunisol.

The surface horizon (Ap) of Series 043 soils is silt loam in texture. The silt content ranges between 55 and 60% while the clay content is generally 15 to 20%. Much of the sand fraction is in the fine and very fine size range.

Underlying the Ap horizon is an eluviated horizon (Ae) which is also silt loam in texture, but the clay content is slightly lower than in the surface due to eluviation. The clay that has been removed from the Ae has accumulated lower in the profile, in the Bt horizon. Clay translocation, however, has been minimal so the clay content of the Bt rarely exceeds 25%. Thus, the texture of the Bt horizon is usually loam or silt loam. The depth to unaltered parent material (solum depth) is most commonly 45-65 cm.

Series 043 correlates well with the Guelph Series as established in Oxford County.

Series 043 soils are Group IV soils when considered for pollutant transfer potential. They have low potential for contributions to both surface water and groundwater.

Series 045

Imperfectly drained soils that have developed from calcareous brown loam and silt loam till are grouped together in Series 045. These soils occur mainly on the lower portions of gentle slopes in association with Series 043 and on very gently sloping topography in association with Series 046. Series 045 also grades into Series 055 where outwash gravelly fine sandy loam occurs at depth in the profile. The taxonomic classification of Series 045 at the subgroup level is Gleyed Orthic Gray Brown Luvisol. In common with Series 043, Series 045 is associated with soils that do not show enough clay accumulation in their B horizon to meet requirements of the Luvisolic Order. Thus, another associate of Series 045 is an unnamed series which is classified at the subgroup level as a Gleyed Degraded Melanie Brunisol.

The surface horizon (Ap) of Series 045 is silt loam in texture and somewhat darker than the Ap of Series 045. This is a result of the slower rate of organic matter decomposition under imperfectly drained conditions.

Underlying the surface horizon is a discontinuous silt loam layer that has been subject to clay eluviation and also to periodic reducing conditions. The clay and other products of eluviation that have been removed from this Aegj horizon have accumulated lower in the profile in a layer designated by the notation, Btgj. Since the extent of clay translocation has been minimal, the texture of the Btg is usually loam, more rarely silt loam or clay loam. The depth to unaltered calcareous parent material is commonly 45-60 cm.

Series 045 correlates well with the London Series as established in Oxford County.

Series 045 is placed with Group II soils. They have moderate potential for contribution to both surface and groundwater.

Series 046

Series 046 consists of poorly drained soils which have developed from calcareous loam and silt loam glacial till. Similar parent material gave rise to Series 043 and 045 under improved drainage conditions. Series 046 soils occur in level to depressional areas of very gently sloping topography mainly in association with Series 045. The taxonomic classification of Series 046 at the subgroup level is Orthic Humic Gleysol.

The surface horizon (Ap) of Series 046 is silt loam in texture, but is somewhat thicker and darker with a higher clay content than the Ap of either Series 043 or 045. Accumulation of colluvium in depressions and the slow rate of organic matter decomposition under poorly drained regimes contribute to this condition.

Underlying the Ap horizon is a layer, loam to silt loam in texture, that is subject to reducing conditions for significant portions of the year. It has also been subject to some eluviation, particularly of clay. The notation used to describe this horizon is Aejg.

Beneath the Aejg is a zone, also loam to silt loam in texture, that is subject to reducing conditions for much of the year and which shows some clay accumulation. This zone can be divided into two or more horizons based on the intensity, extent and color of mottles and on structural development. The notation used in this case is $Btjg_1$ and $Btig_2$, etc.

The solum depth (thickness of A & B horizons) is usually 70-100 cm.

Series 046 correlates well with the Parkhill Series as established in Oxford County.

When considered for pollutant transfer potential, Series 046 is placed in Group V - soils with high potential for contribution to both surface and groundwater.

Series 053

The soils of Series 053 are well drained and have developed in calcareous loam and silt loam till overlying coarse textured glaciofluvial material at depths of 50-100 cm. Series 053 occupies the upper and intermediate portions of 0.5-9% slopes mainly in association with Series 055. Series 053 grades into Series 043 where the depth of the till overburden approaches 100 cm. At the subgroup level, Series 053 is classified as an Orthic Gray Brown Luvisol.

The surface horizon (Ap) of Series 053 is silt loam in texture and is commonly 25-30 cm thick. There tends to be somewhat less clay in the Ap of Series 053 (10-15%) than either of Series 043 or 045 (15-20%). All three series have surface horizon silt contents of 55-60% with much of the sand fraction in the fine and very fine range.

Beneath the Ap is a light colored layer (Ae) that shows evidence of eluviation. The Ae is silt loam in texture and discontinuous.

Material leached from the Ae horizon has accumulated in the underlying Bt horizon. The increase in clay in the Bt places it in the clay loam - sandy clay loam - loam range with the sand content being strongly influenced by the depth of till overburden. The solum depth (thickness of A and B horizons) is generally 55-70 cm. A discontinuous layer of relatively unaltered till (Ck horizon) may underlie the Bt horizon which is, in turn, always underlain by glaciofluvial material that ranges in texture from gravelly fine sandy loam to medium sand (II Ck).

Series 053 does not correlate well with any of the soil series previously established in Oxford County.

Series 053 on less than 5% slope is placed with Group V soils where the potential for contribution to both surface water and groundwater is low. Where slopes exceed 5%, Series 053 is placed with Group I soils - those that have high potential for contribution to surface water and low potential for contribution to groundwater.

Series 055

Series 055 soils are imperfectly drained and have developed in calcareous loam and silt loam till overlying coarse textured glaciofluvial material at 50-100 cm. The soils of Series 055 occupy lower portions of slopes in association with Series 053. They also grade into Series 045 where the depth of the till overburden approaches 100 cm. The classification of Series 055 at the subgroup level is Gleyed Orthic Gray Brown Luvisol.

Series 055 soils show profile development very similar to that of Series 053. Under virgin conditions, differences occur in the surface horizon (Ah) which tends to be thicker and darker in Series 055. The Ae - Bt sequence is not as strongly developed in the imperfectly drained soil and reddish brown mottling is present in Series 055 in all horizons below the surface.

Series 055 does not correlate well with any soil series previously established in Oxford County.

Series 055 soils are Group II when considered for potential for pollutant transfer. They have moderate potential for contribution to both surface water and groundwater.

Series 056

Poorly drained soils developed in 50-100 cm of loam and silt loam till over coarse textured glaciofluvial material are referred to as Series 056. These soils occur in poorly drained depressions and old spillway channels mainly in association with Series 055. Series 056 grades into Series 046 where the depth of the till overburden approaches 100 cm. The taxonomic classification of Series 056 at the subgroup level is Orthic Humic Gleysol.

The texture of the surface horizon of Series 056 is usually silt loam. Accumulation of colluvium from upper slopes and the slow rate of organic matter decomposition under poor drainage conditions make this horizon relatively thick and dark. The underlying horizons show signs of reducing conditions for significant portions of the year. The B horizon may be subdivided into two or more horizons on the basis of the extent and intensity of mottling. Above the lithological discontinuity, soil textures are in the loam to silt loam range, but change to gravelly sandy loam or medium sand below the discontinuity. Solum depth (thickness of A and B horizons) is variable and can range between 50 and 100 cm.

Series 056 does not correlate well with any of the soil series previously established in Oxford County.

Series 056 is placed with Group III soils when considered for pollutant transfer potential. These soils have high potential for contributions to groundwater and low potential for contribution to surface water.

Series 067

Series 067 soils are found in very poorly drained depressions that were formerly occupied by shallow lakes and ponds. These soils are composed of well humified organic matter derived from sedges, mosses, leaf litter and some coarse woody fragments from trees. The organic deposit is 40-160 cm deep and is underlain by calcareous clay and silty clay material of glaciolacustrine origin. A thin layer of marl sometimes occurs above the mineral contact. At the subgroup level, Series 067

is classified as a Terric Humisol. Previous surveys have used the term "muck" to describe all organic soils.

Series 067 is placed with Group I soils when considered for pollutant transfer potential. They have low potential for contribution to groundwater and high potential for contribution to surface water.

Series 077

Series 077 soils are composed of more than 160 cm of well humified organic matter derived from sedges, mosses, leaf litter and some coarse woody fragments from trees. Like Series 067, these soils occur in very poorly drained depressions formerly occupied by shallow lakes and ponds. At the subgroup level, Series 077 is classified as a Typic Humisol.

Previous surveys have used the term "muck" to describe all organic soils.

Series 077 is a Group I soil when considered for pollutant transfer potential. Soils in this group have low potential for contribution to groundwater and high potential for contribution to surface water.

Stream Course Complex (SC)

The stream course complex is a Miscellaneous Land Type used to describe landscapes associated with presently active streams. Both the floodplain and streambank are included in the same unit because of map scale limitations and because both components have the same potential for pollutant transfer. The streambanks consist of glacial till similar to that of adjacent mapping units. The floodplains are made up of water-worked tills and recent deposits of alluvium laid down mainly during spring flooding.

The land type is placed with Group I soils when considered for pollutant transfer potential. They have high potential for contribution to surface water and low potential for contribution to groundwater.

SUBWATERSHED AG-10 (SMITHVILLE CREEK)*

Subwatershed AG-10 is the upper portion of the drainage basin of Smithville Creek which drains into Lake Ontario via Twenty Mile Creek. The 3025 ha study area is approximately 15 km south of Grimsby (Fig 6) near the town of Smithville. AG-10 lies entirely within the boundaries of the old Lincoln County which is now part of the Regional Municipality of Niagara.

AG-10 is representative of low intensity agriculture found in the Regional Municipalities of Haldimand-Norfolk (eastern part); Niagara (central) and Hamilton-Wentworth (southern part). The major crops grown are corn, hay, pasture and small grains. Hogs and poultry are the main livestock enterprises, although some beef and dairy operations are also present. There are also local areas of fruit and vegetable production.

The soils are dominantly very fine clayey with dense B horizons. Thus, the CLI agricultural capability is mainly 2_D. The poorly drained clayey soils in the region are mainly Class 3_W.

Bedrock Geology

AG-10 is underlain by dolomites of the Guelph and Amabel-Lockport Formations (Ontario Division of Mines, 1972). There are no outcroppings of bedrock within the study area. Red shales of the Queenston Formation outcrop below the Niagara Escarpment approximately 15 km to the north of Smithville. Fragments of this red shale are commonly found in the surficial material of AG-10.

Surficial Geology

Subwatershed AG-10 is part of the Haldimand Clay Plain which lies between the Niagara Escarpment and Lake Erie. Chapman and Putnam (1966) describe the northern sector of the region as composed of low moranic ridges while the southern part has typical lake plain features. Intervening between the two areas is a 'confused intermixture of stratified clay and till'.

Feenstra (1975) describes the area occupied by AG-10 as glaciolacustrine interstratified clay and silt overlain by a silty veneer. Wicklund and Matthews (1963) take an opposing viewpoint, describing the surficial materials as lake laid sediment which has subsequently been transported by glacier ice. The latter viewpoint is supported by the lack of varying in the material, the absence of shoreline features, the presence of subrounded chips of Queenston shale from below the Niagara Escarpment and by the presence of some angular gravel and the occasional cobble.

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* This creek has no official name. For convenience in this report, the stream has been called 'Smithville Creek' after the town located nearby. Other investigators have used "North Creek - tributary of Twenty Mile Creek"

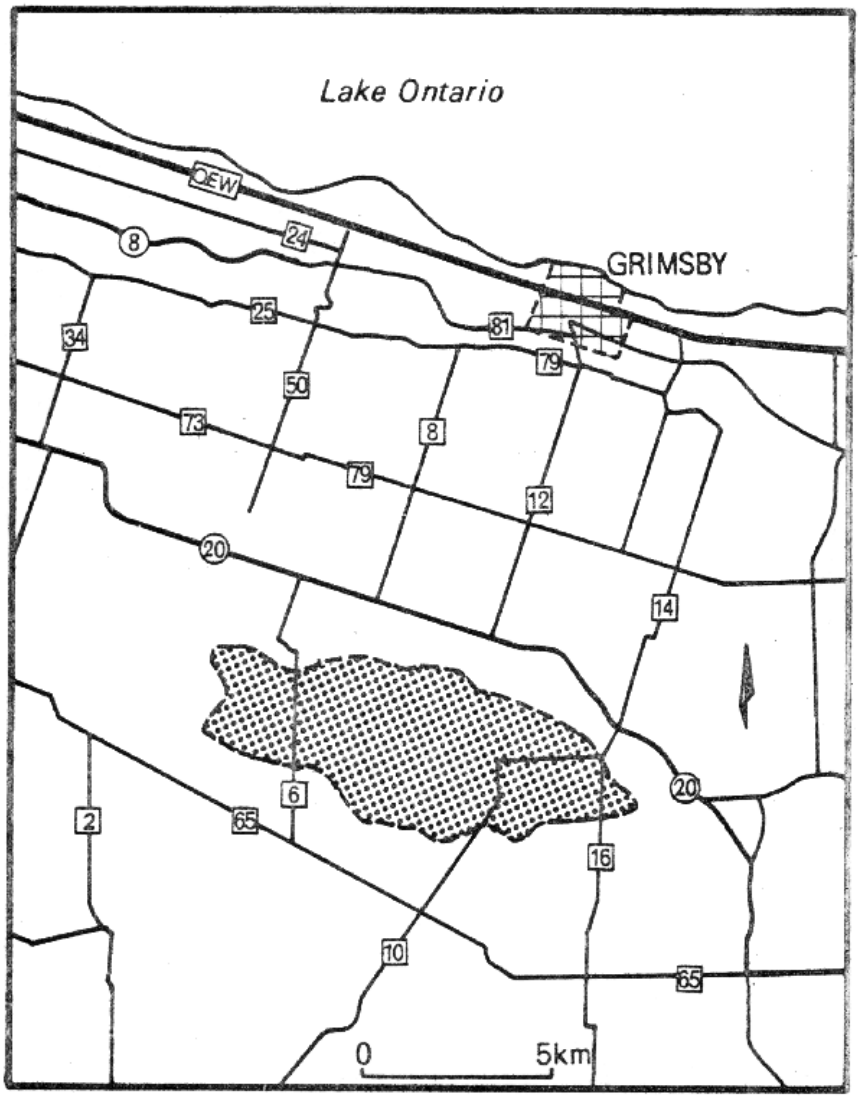

Fig. 6: Location of AG-10

TABLE 11 - Soil Series of AG-10

Particle Size Class or Land Type	Soil Series or Land Type	Slope/ Stoniness Phases	Area		Pollutant Transfer Potential	Agricultural Capability
			Hectares	%		
fine clayey	253	C0	30	1	I	2_D
	255	b0	10	<1	I	2_D
		B0	30	1	I	2_D
		C0	30	1	I	2_D
fine and very	256	b0	25	1	V	3_W
fine clayey	264	C0	335	11	I	2_D
		c0	145	5	I	2^T_D
	265	b0	980	32	I	2_D
		B0	50	2	I	2_D
		C0	220	7	I	2_D
	266	b0	955	32	V	3_W
		B0	45	1	V	3_W
stream course complex	SC	--	170	6	I	variable

For the reasons mentioned above, the dominant soil parent material in AG-10 has been referred to as glacial till in this report. Further gains and losses studies are required to decide the question of whether the silty clay loam surface textures in the area are related to pedogenic processes or to glaciolacustrine overburdens. Previous work has indicated that overburdens are common on these soils (Matthew et al, 1955).

Distribution of Soils in AG-10

Approximately 90% of AG-10 is made up of fine and very fine clayey soils (Table il). The remainder is either part of a stream course complex or has a fine loamy underburden. Two-thirds of the soils are Group I for pollutant transfer potential and the remainder fall into Group V (Table 12).

TABLE 12 - Pollutant Transfer Potential of the Soils of AG-10

Group	Hectares	%
I	2000	66
V	1025	34
Total	3025	100

Generalized Soil Series Descriptions

Series 253

Series 253 includes all well drained soils that have developed from calcareous grayish brown clay till overlying olive brown silty clay loam and silt loam at 50-100 cm. These soils occur on the upper and intermediate portions of 0.5-5% slopes mainly in association with Series 255. Series 253 grades into Series 264 as the silty underburden disappears. At the subgroup level, Series 253 is classified as an Orthic Gray Brown Luvisol.

The surface horizon (Ap) is generally 15-20 cm in thickness and silty clay loam in texture. Locally, silty clays or silt loams may be encountered. The Ap is underlain by a zone of eluviation, the Ae horizon, which is generally silty clay loam in texture. Weathering products from the upper portion of the profile have accumulated below the Ae in the Bt horizon. The Bt is heavy clay to silty clay in texture and has a strong prismatic structure which breaks readily into angular blocky peds. The peds are coated with organic matter and clay skins giving them a dark grayish brown exped color. The depth to free carbonates is generally 55-70 cm depending mainly on the depth to the underlying silty clay loam.

Series 253 does not correlate well with any previously established soil series.

Series 253 is a Group I soil when considered for pollutant transfer potential. These soils have low potential to contribute to groundwater and high potential to contribute to surface water systems.

Series 255

Series 255 includes all imperfectly drained soils that have developed from calcareous grayish brown clay overlying olive brown silty clay loam and silt loam at 50-100 cm. These soils occur on the lower portions of 2-5% slopes in association with Series 253 and on the upper portions of 0.5-2% slopes in association with Series 256. Series 255 soils grade into Series 265 soils as the silty underburden thins out or dips more than 100 cm below the surface.

The surface horizon is 15-20 cm in thickness and is slightly darker than that of Series 253 because of the slower rate of organic matter decomposition under imperfectly drained conditions. The next underlying horizon, the Aegj is subject to periodic reducing conditions as well as being a zone of eluviation. The clay that has been leached from the upper portion of the profile has accumulated in the next underlying horizon, the Btgj. The B horizon is generally silty clay to clay in texture and displays a prismatic structure. The prisms easily break to an angular blocky arrangement.

Series 255 does not correlate well with any preciously named soil series.

Series 255 soils are Group I soils when considered for pollutant transfer potential. These soils have high potential to contribute to surface water systems, but low potential to contribute to groundwater systems.

Series 256

Poorly drained soils developed from calcareous clay to silty clay materials over silty clay loam materials are grouped into Series 256. These soils occur on 0.5-2% slopes generally in association with Series 255. At the subgroup level Series 256 is classified as an Orthic Humic Gleysol.

The surface horizon (Ap) is generally silty clay loam in texture although some silt loams and silty clays were encountered. A highly mottled zone, the Bg horizon, underlies the Ap. Where tile drainage is absent, this horizon and all horizons beneath are saturated with water for significant portions of the growing season. The texture of the Bg is generally clay to silty clay but heavy clays were encountered. The depth to free carbonates is 45-60 cm, which commonly coincides with the silty clay loam II Ckg horizon.

Series 256 does not correlate well with any previously named soil series.

Series 256 is a Group V soil when considered for pollutant transfer potential. These soils have high potential to contribute to both surface water and groundwater systems.

Series 264

Series 264 includes all moderately well drained soils developed from calcareous clay to silty clay glacial till in AG-10. These soils occur on the upper and intermediate portions of simple 2-5% slopes in association with Series 265. Where the topography becomes more complex, Series 264 occurs on 2-5% slopes in association with Series 266 in depressional areas. At the subgroup level, Series 264 is an Orthic Gray Brown Luvisol.

The surface horizon (Ap) of Series 264 soils is generally silty clay loam in texture and about 15 cm thick. Eroded knolls are often silty clay and heavy clay at the surface because of the incorporation of B horizon material into the plow layer. The Ae horizon, a zone of eluviation, is most commonly silty clay loam and has faint to distinct mottling at its base.

The Bt horizon has thick clay skins on ped surfaces due to the accumulation of clay in this zone. Textures vary from silty clay to heavy clay, but the structure is always a strong prismatic arrangement. The prisms readily break down to a strong angular blocky structure.

The calcareous Ck horizon is gray to dark grayish brown in color and occurs at a depth of 45-55 cm from the surface. Where severe erosion has occurred, the depth is somewhat shallower. Prismatic structure and clay to silty clay to heavy clay textures are typical of this material.

Series 264 does not correlate with any previously named soil series.

Series 264 is a Group I soil when considered for pollutant transfer potential. This group has high potential to contribute to surface water and low potential to contribute to groundwater systems.

Series 265

Series 265 soils are imperfectly drained and have developed from clay to silty clay glacial till. Similar material gave rise to Series 264 and 266 soils under different drainage conditions. Series 265 occurs on the lower portions of 2-5% slopes in association with Series 264 and on the upper portions of 0.5-2% slopes in association with Series 266. At the subgroup level, Series 265 is classified as a Gleyed Orthic Gray Brown Luvisol.

The Ap of Series 265 is most commonly 15 cm thick and ranges in texture from silt loam to silty clay but silty clay loam is most common. The underlying horizon, the Aegj, is highly mottled due to watertables perched on the B horizon. On lower slope positions iron and manganese concretions are abundant in the Aegj and some have been incorporated into the plow layer. This accounts for the high oxalate and pyrophosphate extractable iron found in the surface horizons of some of these soils.

The Btgj horizon shows evidence of clay accumulation and also some mottling indicative of periodic reducing conditions. The texture of this horizon ranges from silty clay to heavy clay and the primary structure is prismatic. The prisms easily break down to an angular blocky arrangement when disturbed.

The solum thickness (depth of A and B horizons) is 45-55 cm. At this point, the gray calcareous Ckgj horizon begins. Its texture ranges from silty clay to heavy clay. The structure is again prismatic, but slightly less well developed than that of the B horizon. The prisms readily break down into an angular blocky arrangement slightly coarser and weaker than found in the B horizon.

Series 265 correlates with the Haldimand Series as established in Lincoln County.

Series 265 is a Group I soil when considered for pollutant transfer potential. It has high potential to contribute to surface water systems and low potential to contribute to groundwater

systems.

Series 266

The soils of Series 266 have developed from poorly. drained calcareous clay to silty clay to heavy clay materials found in AG-10. Similar material gave rise to Series 264 and 265 in better drained locations. Series 266 soils occur in depressional areas in association with Series 264 and 265. Due to their topographic position, Series 266 soils have received colluvium from upper slope positions and were the sites of shallow ponding from time to time during their development. Series 266 are classified as Orthic Humic Gleysols at the subgroup level.

The Ap horizon is usually 15 cm thick except when accelerated erosion has occurred on the surrounding slopes. In these cases, there may be a colluvial layer as deep as 30-60 cm over the original surface. The most common surface texture is silty clay loam to silty clay although some silt loam surfaces do occur.

The highly mottled Bg horizon underlies the Ap. It is generally 25 -50 cm in thickness, silty clay to clay in texture and displays the prismatic structure common to Series 265 and 264. The columns break readily to an angular blocky arrangement when disturbed.

Free carbonates indicative of the Ckg horizon begin at 35-60 cm beneath the surface. Extensive bright colored mottling is present, indicating reducing conditions throughout significant portions of the year. The texture ranges from silty clay to heavy clay and the primary structure is again prismatic breaking to angular blocky.

Series 266 correlates with the Lincoln Series as established in Lincoln County.

Series 266 is a Group V soil when considered for pollutant transfer potential. These soils have high potential to transmit pollutants to both surface water and groundwater.

Stream Course Complex (SC)

The stream course complex is a Miscellaneous Land Type used to describe landscapes associated with presently active streams. Both the floodplain and streambanks are included in the same mapping unit because of map scale limitations. The width of the unit may be exaggerated on certain portions of the map to depict continuity and to simplify the insertion of map edits.

This land type is Group I when considered for pollutant transfer potential. Group I soils have high potential to contribute to surface water but low potential to contribute to groundwater systems.

SUBWATERSHED AG-13 (HILLMAN CREEK)

Subwatershed AG-13 is drained by the headwaters of the west branch of Hillman Creek which flows into Lake Erie. The study area consists of 1990 ha directly to the north of Leamington in Essex County (Fig 7).

AG-13 is representative of a number of small areas in Southern Ontario where orchard and horticultural crops are dominant. Greenhouse crops and field crops including corn, tobacco, soybeans and potatoes are also common in AG-13. There is only one livestock enterprise within the subwatershed - a small dairy farm in the northwestern sector. Urban pressure, mainly in the form of rural non-farm strip development, is increasing within the boundaries of AG-13.

The soils in the area are mainly imperfectly to poorly drained and medium to coarse textured. The imperfectly drained medium textured soils are CLI Class 1 for agriculture, while the sandy soils have slight fertility limitations (Class 2_F). The poorly drained medium textured soils are Class 3W (wetness) and poorly drained sandy soils are 4_W. Small amounts of poorly drained fine textured soils occur near the centre of the study area. These soils are Class 2_W.

Bedrock Geology

Subwatershed AG-13 is underlain by the Detroit River Formation and the Dundee Formation, both of which belong to the Devonian Period (Ontario Division of Mines, 1972). The Detroit River Group is the oldest and underlies the souteastern portion of the watershed. It consists of dolomite and limestone with some gypsum and chert while the Dundee Formation is light brown, limestone with some chert and usually with basal sandstone (Martini, Protz and Chesworth, 1970). Neither of these formations outcrop within the study area.

Surficial Geology

Subwatershed AG-13 is located in an area where broad aprons of glaciolacustrine gravel, sand and silt interrupt the continuity of the St. Clair Clay Plain (Chapman and Putnam, 1966). Units that have previously been identified within the watershed boundary include glaciolacustrine gravel, medium sand, interbedded silt and clay, medium sand overlying silt and clay, as well as a fine textured glacial till which is occasionally overlain by thin deposits of medium sand (Vagners, 1972). These units comprise the basic soil parent material separations for the present survey. The exception is that Vagners' silt and clay unit is better described as laminated silt and very fine sand within the study area. A small deposit of shallow, well humified organic material was identified in association with the beach ridge that forms the western boundary of the subwatershed.

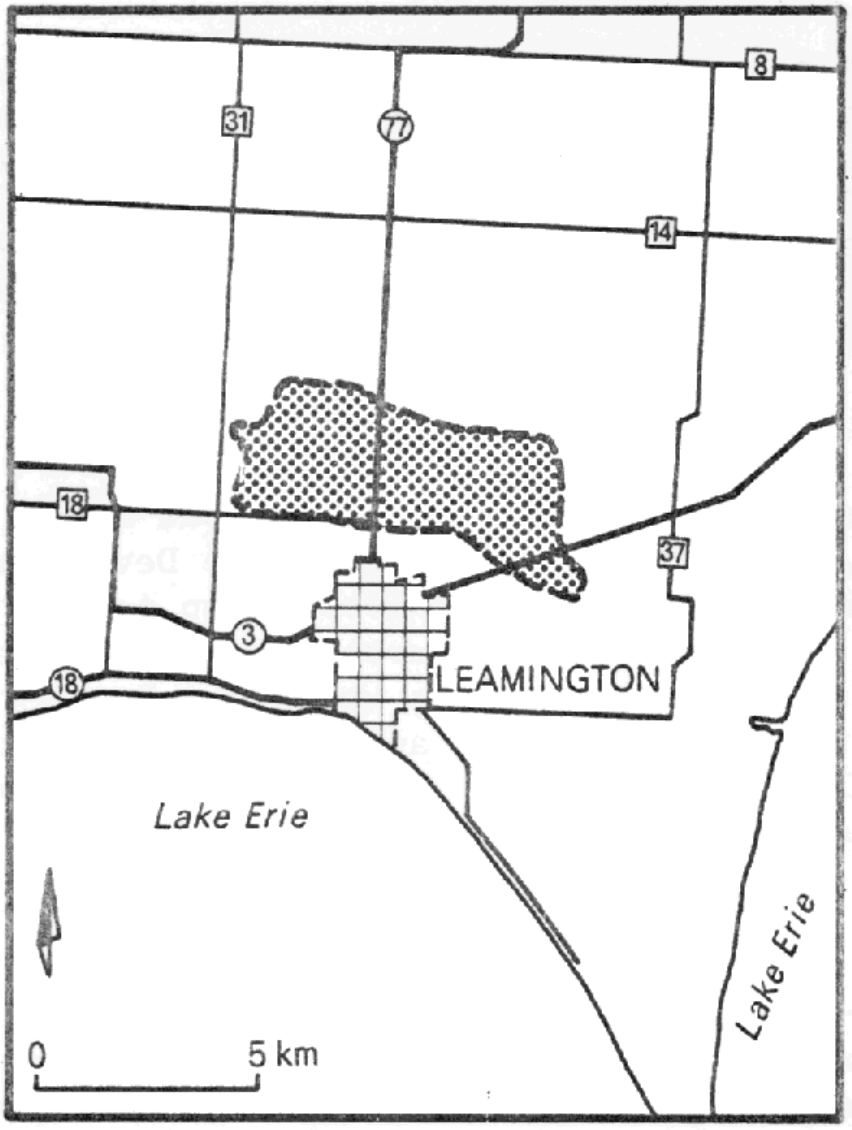

Fig. 7: Location of AG-13

TABLE 13 - Soil Series of AG-13

Particle Size Class or Land Type	Soil Series or Land Type	Slope/ Stoniness Phases	Area		Pollutant Transfer Potential	Agricultural Capability
			Hectares	%		
loamy-skeletal	083	CO	40	2	III	2^{F}_{M}
coarse loamy	093	BO	60	3	III	2^{F}_{M}
	095	BO	85	4	III	2_{F}
sandy	096	BO	30	2	III	4_{W}
	103	BO	25	1	III	2^{F}_{M}
	105	BO	360	18	III	2_{F}
	106	BO	115	6	III	4_{W}
coarse loamy	115	BO	265	13	II	1
	115s	BO	250	13	II	1
	116	AO	10	<1	V	3_{W}
		BO	275	14	V	3_{W}
coarse loamy	125	BO	45	2	IV	2F
over fine loamy	126	BO	20	1	IV	4_{W}
fine clayey	136	AO	190	10	V	2_{W}
organic	147	BO	<5	<1	I	unclassified
stream course complex	SC	--	215	11	I	variable
disturbed land	DL	--	<5	<1	III	unclassified

Much of the eastern sector of the study area was previously reported to consist of 0.9-1.8 meters (3-6 feet) of sandy loam material overlying fine textured glacial till (Richards, Caldwell and Morwick, 1949). Although present day soil surveys usually do not attempt to describe materials to a depth greater than one meter, numerous borings were made to a depth of two meters where it was suspected that the till was near the surface. Only in isolated cases was a till contact found above two meters although the silt content usually increased with depth.

Distribution of Soils in AG-13

Table 13 shows the particle size classes, slope and stoniness phases, areal extent and pollutant transfer potential of the soil series recognized in AG-13. The majority of soils in the study area belong either to the sandy or coarse loamy family groupings. Natural drainage is mainly imperfect and poor owing to the general flatness of the terrain.

Table 14 shows that most of the soils in the subwatershed fall into Group II, III and V when considered for pollutant transfer potential. The Group I soils comprising 11% of the area are associated with areas immediately adjacent to stream courses.

TABLE 14 - Pollutant Transfer Potential of the Soils of AG-13

Group	Hectares	%
I	215	11
II	515	26
III	720	36
IV	65	3
V	475	24
Total	1900	100

Generalized Soil Series Descriptions

Series 083

Series 083 consists of well-drained soils that have developed on gravel and gravelly sand deposited as beach ridges. These soils occur on the upper and intermediate portions of 2-5 slopes in the extreme north-western sector of Hillman Creek Watershed. Series 083 soils are often associated with shallow organic soils (Terric Humisols) which develop as a result of seepage on the lower and toe slope positions of the gravelly ridges in the western portions of AG-13. Series 083 is classified as an Orthic Gray Brown Luvisol at the subgroup level.

The surface horizon (Ap) is commonly 15 cm thick, gravelly sandy loam in texture and has very weak structural development. Most of the sand fraction is in the coarse to medium range and this characteristic, together with the high gravel content, makes the surface highly permeable to water.

Underlying the surface is a grayish layer (Ae) that has had much of its clay removed through leaching. These products have reprecipitated in the next underlying layer, the Bt. The Bt horizon has a clay content of 25-30% and averages 40 cm in thickness. Series 083 therefore has a greater water holding capacity than might be expected of soils developed on such coarse material. The solum depth is extremely variable due to the tonguing nature of the B horizon.

Series 083 correlates well with the Burford Series as established in Essex County.

Series 083 is placed with Group III soils when considered for pollutant transfer potential. They have high potential for contribution to groundwater but low potential for contribution to surface water.

Series 093

Series 093 soils have developed on well-drained sites in medium sands of glaciolacustrine origin. They occur on the upper slopes of very gently sloping topography in association with Series 095. At the subgroup level, Series 093 is an Orthic Gray Brown Luvisol.

The surface horizon (Ap) is loamy sand in texture and commonly 20-25 cm thick. This is underlain by an eluviated, lighter colored horizon (Ae) followed by a zone of clay accumulation, the Bt horizon. The clay content of the B horizon is 20-25% which contrasts sharply with the 5-10% found in the Ae and Ck horizons. The sand fraction throughout the profile lies dominantly in the medium size range. The solum thickness is 80-10(

Series 093 correlates well with the Fox Series as established in Essex County.

Series 093 is placed in Group III when considered for pollutant transfer potential. These soils have high potential to contribute to groundwater and low potential for transfer to surface water.

Series 095

The soils of Series 095 have developed in medium sands of glaciolacustrine origin in imperfectly drained situations. They occur on the lower portions of very gently sloping topography in association with Series 093. Series 096 occurs in poorly drained depressions of the same landscape. At the subgroup level Series 095 is classified as a Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) is 25-30 cm thick and is loamy sand in texture. Underlying the Ap is a mottled grayish zone of eluviation that is subject to seasonal reducing conditions. This condition is described by the notation, Aegj. The Aegj horizon is, in turn, underlain by a zone of clay and sesquioxide accumulation that is also subject to seasonally high water tables. The notation Btgj is used to describe this situation. Depth to the calcareous C horizon is approximately 85 cm, but can vary due to the tonguing nature of the B horizon.

Series 095 is similar to the Brady Series as described for Essex County.

Series 095 soils are Group III when considered for pollutant transfer potential. These soils have high potential for contribution to groundwater and low potential for contribution to surface water.

Series 096

Series 096 is the poorly drained associate of Series 093 and 095. All these soils have developed from similar parent material, but occupy different landscape positions so each series is associated with a specific drainage condition. Series 096 occupies poorly drained level to depressional segments of the landscape. It is classified as an Orthic Humic Gleysol at the subgroup level.

The surface horizon (Ap) of Series 096 is thicker and darker than those of its better drained associates. A humic layer has accumulated over the mineral soil where seepage has led to very poorly drained conditions. Thus a peaty phase of Series 096 may be encountered as inclusions on lower slopes of delineations mapped as either 096 or 095.

Unlike Series 093 or 095, Series 096 shows no evidence of clay translocation in its profile. This B horizon is intensely mottled and can be subdivided into two or more layers based on size, extent and color of mottles. The depth to the calcareous C horizon is variable but is generally 90-120 cm.

Series 096 correlates well with the Granby Series as established in Essex County except that

the profile of 096 contains some fine gravel.

Series 096 soils are Group III when considered for pollutant transfer. This group has high potential for contribution to groundwater and low potential for contribution to surface water.

Series 103

Series 103 consists of well drained soils developed in loamy very fine sand and fine sand of glaciolacustrine origin. These soils make up a very small portion of the total area of Hillman Creek Watershed and occur mainly as inclusions with Series 105. At the subgroup level, Series 103 is classified as an Orthic Melanic Brunisol.

The surface horizon (Ap) is commonly 15-20 cm thick and is loamy sand in texture. Underlying the surface are one or more Bm horizons that show some iron accumulation and minimal clay accumulation. The calcareous C horizon occurs between 80 and 120 cm.

Series 103 does not correlate well with any of the soil series previously established in Essex County. When considered for pollutant transfer potential, Series 103 is placed with Group III soils. These soils have high potential for contribution to groundwater and low potential for contribution to surface water.

Series 105

Series 105 is made up of imperfectly drained soils developed in loamy very fine sand and fine sand of glaciolacustrine origin. These soils are very common in Hillman Creek Watershed and occur in association with both Series 103 and 106. At the subgroup level, Series 105 is classified as a Gleyed Orthic Melanic Brunisol.

The surface (Ap) horizon is loamy sand in texture with most of the sand fraction in the fine size range. Structural development is very weak so the pore space tends to be interstitial and of a discontinuous nature. The rate at which water moves into the surface of these soils is comparatively slow for those reasons.

The surface is underlain by a very thick Bgj or Bm horizon that usually extends to more than 100 cm below the surface. It is possible to subdivide the B horizon into two or more layers based on matrix color and the extent and prominence of mottles. Boundaries between subhorizons are diffuse. The calcareous C horizon becomes more finely bedded with depth and in some cases can closely resemble the laminated very fine sandy loam to loam to silt loam that forms the parent material of Series 115. Instances where fine textured glacial till was found within 2 meters of the surface were rare.

Series 105 does not correlate well with any soil series previously established in Essex County.

When considered for pollutant transfer potential, Series 105 falls into Group III. These soils have high potential for contribution to groundwater but low potential for contribution to surface water.

Series 106

Series 106 includes poorly drained soils that have developed from material similar to that which gave rise to Series 103 and 105. All of these series have deep sandy profiles that tend to become more finely bedded and slightly finer textured with depth. Series 106 is an Orthic Humic Gleysol when classified at the subgroup level.

Series 106 is characteristic of soils in its subgroup. The Ah horizon is thick and dark as a result of the slow rate of organic matter decomposition under poorly drained conditions. The underlying Eg horizon may be subdivided on the basis of intensity and extent of reddish brown mottling which is indicative of poorly drained conditions.

The calcareous C horizon is generally found at depths greater than 100 cm. Series 106 is comparable to the Granby Series as established in Essex County. However, the Granby Series occurs in association with Luvisolic soils, whereas Series 106 occurs with Brunisolic Soils.

Series 106 soils are considered to be Group III soils when considered for pollutant transfer potential. These soils have high potential for contribution to groundwater and low potential for contribution to surface water.

Series 115 and 115s

The soils of Series 115 are imperfectly drained and have developed from laminated material of glaciolacustrine origin. Textures of the parent material range from very fine sandy loam to loam or silt loam over short distances both laterally and vertically. Series 115 commonly occurs in association with Series 116. At the subgroup level, Series 115 is classified as a Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) is very fine to fine sandy loam in texture, but becomes coarser, generally loamy fine sand, in the sandy (s) phase. Series 115s has been used to describe situations where an overburden of fine sandy material was deposited over the laminated parent material associated with Series 115. Thus Series 115s and Series 105 grade into one another on the basis of parent material texture.

Underlying the Ap horizon of the Series 115 is an eluviated layer that is also subject to periodic reducing conditions. The notation "Aegj" is used to describe this situation. In some cases, the Aegj horizon can be split into two layers on the basis of color, with the upper layer generally of higher chroma than the lower. Taxonomically these soil individuals are Gleyed Brunisolic Gray Brown Luvisol subgroups and are considered as tax-adjacents of Series 115 in AG-13.

The next underlying horizon is termed Btgj to indicate both clay accumulation and the presence of seasonal reducing conditions. This layer may be subdivided into two layers based on texture which reflects the extent of clay accumulation and on structure.

The calcareous C horizon usually occurs at a depth of 60-90 cm. It is yellowish brown in color and has a pseudo-platy structure that is associated with its mode of deposition. In rare instances, fine textured glacial till may underlie the C horizon at 100-150 cm.

Series 115 correlates well with the Tuscola Series as established for Essex County although no sandy phase has previously been recognized.

Series 115 and 115s are Group II soils that have moderate potential to contribute pollutant to both groundwater and surface water.

Series 116

Series 116 includes poorly drained soils that have developed in parent material similar to that which gave rise to Series 115. The two series occur in association with one another; the poorly drained soils occurring in level to depressional areas of very gently sloping landscapes. Series 116 occasionally occurs in depressional areas in association with Series 105. Series 116 is classified as an Orthic Humic Gleysol at the subgroup level.

The surface horizon (Ap) of Series 116 is very fine to fine sandy loam in texture and is thicker and darker than that of Series 115. The underlying B horizon may be subdivided into two or more layers on the basis of intensity and extent of mottling. The average texture of the B horizon varies from very fine sandy loam to loam, but a single textural class is misleading because of the laminar nature of the material. The calcareous C horizon usually occurs at about 100 cm.

Series 116 correlates well with the Colwood Series as established in Essex County.

Series 116 is placed with Group V soils. This group has high potential to contribute pollutants to both groundwater and surface water.

Series 125

These soils have developed in glaciolacustrine sandy loam material that overlies clay till at 50-100 cm. Series 125 soils are imperfectly drained, occurring on the upper and intermediate portions of 0.5-2% slopes mainly in association with Series 126. They grade into Series 105 as the sandy overburden becomes deeper and are also found as inclusions in the 136 (clay till) mapping unit. Series 125 is classified as a Gleyed Orthic Gray Brown Luvisol.

The surface horizon (Ap) is 20-25 cm thick and generally sandy loam. Loamy sands may also be encountered. Underlying the Ap is a discontinuous mottled grayish zone (aegj) that is loamy sand in texture and rarely more than 10 cm thick. The clay and that have been leached from the Aegj have accumulated lower in the profile in the Btgj horizon. The calcareous loamy sand horizon (Ckgj) that underlies the B is discontinuous and is often replaced by the II Ckgj horizon, the clay till. Solum depth is 45-60 cm depending mainly on the overburden thickness.

Series 125 correlates with the Berrien Series as established in Essex County except for depth criteria. The Berrien Series previously established in Essex had sandy overburdens of 90-180 cm (3-6 feet) while Series 125 has overburdens of 50-100 cm.

Series 125 soils are placed with Group IV when considered for pollutant transfer potential. These soils have low potential to contribute to both surface water and groundwater.

Series 126

Series 126 soils are poorly drained and have developed in 50-100 cm of glaciolacustrine sandy loam overlying clay glacial till. They occur in poorly drained depressional areas mainly in association with Series 125. They grade into Series 106 as the sandy overburden becomes deeper and are found as inclusions in the 136 mapping unit. At the subgroup level, Series 126 is classified as an Orthic Humic Gleysol.

The surface horizon (Ap) is 25-30 cm thick and generally sandy loam in texture. The B horizon is strongly mottled which is indicative of a high water table for significant portions of the year. It is generally loamy sand of sandy loam in texture. Free carbonates usually occur at the till contact, or II Ckg horizon at a depth of 50-100 cm.

Series 126 correlates with the Wauseon Series as established in Essex County except for the depth of overburden criteria. The Wauseon Series previously included all poorly drained sandy material from 90-180 cm (3-6 feet) over clay till.

Series 126 soils are Group IV soils for pollutant transfer potential. These soils have low potential to contribute to both surface water and groundwater.

Series 136

Series 136 is made up of poorly drained soils which have developed in calcareous clay and silty clay glacial till that has been slightly modified by lake action. Series 136 soils occur on level landscapes (00.5% slope) but slight elevations occur as slope inclusions in the mapping unit. These inclusions are made up of imperfectly drained soils belonging either to Series 125 or to an unnamed series developed from clay to silty clay glacial till. Similar material occurs at depth in Series 125 and 126 profiles. At the subgroup level, Series 136 is classified as an Orthic Humic Gleysol.

The surface horizon (Ap) is 15-25 cm thick and is generally clay loam in texture. Inclusions in the 136 mapping unit include a soil that has up to 50 cm of sandy loam glaciolacustrine material overlying the clay till. These instances occur very rarely and are usually found along glacial till - glaciolacustrine material boundaries. No mapping unit was established to describe these soils separately.

The Ap horizon is underlain by one or more heavily mottled Bg horizons generally clay in texture with strong subangular blocky structural development. The calcareous C horizon occurs at a depth of about 80 cm and ranges from clay to silty clay in texture.

Series 136 correlates well with the Brookston Series established in Essex County.

These soils are Group V when considered for pollutant transfer potential. They have high potential to contribute to both surface water and groundwater systems.

Series 147

Series 147 is found in seepage areas associated with Series 083. These soils are composed of well humified organic matter derived from sedges, mosses and leaf litter. The organic deposit is 40-160 cm deep and is underlain by a thin layer of marl followed by brown calcareous fine sand and fine sandy loam. At the subgroup level, Series 147 is classified as a Terric Humisol.

Pervious soil surveys identified all organic soils as "muck".

Series 147 soils are Group I when considered for pollutant transfer potential. This group has high potential to contribute to surface water and low potential to contribute to groundwater.

Stream Course Complex (SC)

This Miscellaneous Land Type includes the streambanks and floodplains of presently active streams. In the Hillman Creek area, it also includes disturbed land associated with stream widening and straightening. The texture of the streambank material is generally similar to that of adjacent mapping units. Clay till outcroppings are common on the lower portions of the banks. The width of the unit is sometimes exaggerated on the map to depict continuity and to facilitate the insertion of map edits.

Disturbed Land (DL)

This land type includes areas highly disturbed by man's activities. In the Hillman Creek area, it has been used exclusively to include areas of sand and gravel extraction. These areas are placed with Group III when considered for pollutant transfer potential. This group has high potential to contribute to groundwater and low potential to contribute to surface water.

A COMPARISON OF FINDINGS WITH THOSE OF RECONNAISSANCE SOIL MAPS

Table 15 shows the extent of the major soil series and land types encountered in each subwatershed. These figures are shown in comparison with the extent of similar series appearing on the appropriate County Soil Survey map. Significant differences occur between the original county maps and the remapped watershed areas in every case.

Some discrepancies can be attributed directly to the scale of the final maps. The County Soil maps (Essex, Huron, Oxford, Wellington and Lincoln) are all at a scale of 1:63,360 while the subwatershed maps are at the larger scale of 1:25,000. Intricate patterns of soils can be depicted more readily at the larger scale simply because there is more space on a large scale map to depict a given area on the ground. Maps of larger scale also allow mapping units to be more closely defined. Thus, minor soils that were ignored in reconnaissance surveys can be accomodated at more detailed levels.

The information conveyed by the mapping symbol differs between the two sets of maps. The County Soil maps in question use taxonomic soil series as mapping unit names. Only one name was allowed to occupy a single map delineation. Up to 15% inclusions were assumed. An inclusion is a soil with properties that fall outside the range defined for the map symbol. The method employed in the present study also uses taxonomic soil series as mapping unit names. (The fact that soil numbers rather than soil names are used makes no difference). However, two series may occupy the same delineation with decile superscripts used to denote proportion. This technique is a useful aid in describing complex soil patterns more accurately.

The type of discrepancy between the two sets of maps varies from area to area. In AG-1, the dominant soil is poorly drained and fine textured according to both maps. However, the reconnaissance map uses the Brookston sand phase to describe the occurrance of shallow, isolated sandy deposits over the clay. This pattern was described as a complex of Series 165 and 176 in the newer report. It was also possible to delineate some areas of imperfectly drained soils at the larger scale.

In AG-3, both maps agree that the dominant soil material is a moderately fine textured glacial till. However, the distribution of drainage classes varies considerably. The area of poorly drained soils increases significantly at the larger scale, with a corresponding decrease in the extent of moderately well drained soils. These differences can be attributed to the intimate association of all three drainage categories and the inability to separate them on a reconnaissance map.

TABLE 15: A Comparison Of Soil Distribution: Reconnaissance Vs Semi-detail Maps

Subwatershed	Soil Series/Land Type		Extent (%)*	
	Semi-Detail	Reconnaissance	Semi-Detail	Reconnaissance
AG-1	165	Berrien	5	1
(Essex Co)	175	Perth	7	0
	176	Brookston	81	98
AG-3	206	-	6	0
(Huron, Perth Co)	225	-	6	0
	234	Huron	22	51
	235	Perth	25	36
	236	Brookston	30	7
AG-4	024	Huron	23	45
(Wellington Co)	025	Perth	42	36
	026	Brookston	22	7
	SC	Bottom Land	7	5
AG-5	043	Guelph	24	40
(Oxford Co)	045	London	33	0
	046	Parkhill	23	4
	056	-	6	0
	SC	Bottom Land	8	1
	-	Honeywood	0	13
	-	Embro	0	37
AG-10	264	-	16	0
(R.M. Niagara	265	Haldimand	41	100
formerly Lincoln Co)	266	Lincoln	33	0
	SC	Bottom Land	6	0
AG-13	093	Fox	3	6
(Essex Co)	105	-	18	0
	115	Tuscola	13	7
	115s	-	13	0
	116	Colwood	14	0
	125	Berrien	2	74
	136	Brookston	10	0
	SC	Bottom Land	11	4
	-	Caistor	0	7

* includes only those soils estimated to cover more than 5% of any subwatershed according to at least one map.

The pattern in AG-4 is also one of close agreement on soil parent material but a significant difference exists in the estimate of natural drainage condition. The amount of imperfectly and poorly drained soils is higher on the more detailed map.

The semi-detail map of AG-5 shows that more of the area is poorly drained than was indicated by the reconnaissance map. There was also a change in parent material from the Honeywood catena to the Guelph catena. However, most soil interpretations would not be affected by this alteration. Thus, it is not as important as the shift in drainage class from well to poorly drained.

The major change in AG-10 was also a shift in drainage categories. In this case, the estimate of the amount of imperfectly drained soils was reduced while the estimates for moderately well and poorly drained soils were increased. Again, these changes were mainly the result of the change in map scale.

The estimate of soil drainage in AG-13 is similar on both reconnaissance and semi-detail maps: dominantly imperfectly and poorly drained. However, there is little agreement as to soil parent material. The reconnaissance map shows a dominance of sandy over clayey material (Berrien) while the semi-detail map shows a dominance of deep sandy (Series 105) and deep silty (Series 115, 115s, 116) material. This change is significant for any predictions involving the movement of groundwater.

WATER TRANSMISSIBILITY MEASUREMENTS AT SELECTED SITES

One of the factors governing the pollutant transfer potential of a soil is the rate at which water enters and moves through the soil profile. In an attempt to quantify this factor, water transmissibility studies were carried out at a total of sixteen sites representing the major soils of the six agricultural subwatersheds chosen for detailed study.

A list of the selected sites and a summary of their natural drainage and particle size groupings is presented in Table 16. Detailed descriptions of each site are provided under the heading of the appropriate subwatershed in the Appendix of this report.

The techniques used to measure the rate of water movement at the selected sites were the air entry permeameter method which measures saturated hydraulic conductivity (Ks), the falling head double ring infiltrometer method which measures steady state infiltration (SSI_F), and the constant head double ring infiltrometer which also measures steady state infiltration (SSI_K) .

Measurements were taken in the spring, summer and fall seasons at each site to determine:

1) the seasonal differences, if any, in water transmissibility characteristics at a given site and

2) logical groupings of soils according to their ability to transmit water and

3) an evaluation of the variable that may control the rate of water entry into soils.

Detailed descriptions and analytical data for these sites are presented in the various appendices of this report.

TABLE 16 - A Summary of the Sites Selected for Water Transmissibility Studies

Site	Drainage	Textural Family	Soil Series	Nearest Named Series
1.1	poor	fine clayey	176	Brookston
1.2	poor	fine clayey	176 (variant)	Brookston
3.1	poor	fine clayey	226	Brookston
3.2	imperfect	fine clayey	235	Perth
3.3	moderately	fine clayey	234	Huron
4.1	poor	fine clayey	026	Brookston
4.2	imperfect	fine silty	025	Perth
4.3	moderately	fine clayey	024	Huron
5.1	poor	fine loamy	046	Parkhill
5.2	good	coarse loamy	043 (taxadjunct)	Guelph
5.3	imperfect	fine loamy	045	London
10.1	poor	fine clayey	266	Lincoln
10.2	imperfect	fine clayey	265	Haldimand
13.1	imperfect	coarse loamy	115s	Tuscola
13.2	imperfect	sandy	105	-
13.3	imperfect	coarse loamy	115s	Tuscola

Statistical Methods

Statistical evaluation of the data began with a test for homogeneity of variance. A plot of means versus variances showed positive correlations which were particularly high in the cases of K_S and SSI_F. The correlation was slightly weaker in the case of SSI_K. When a $\log_{10}$ transformation of the original data was employed, homogeneity of variance was achieved.

The second step in the evaluation involved the use of two-way analysis of variance to test for:

1) significant differences between sites,
2) significant differences between seasons,
3) significant interactions between site and season.

The ANOVA program of the Statistical Package for Social Science at the University of Guelph was used for this purpose.

Finally, a modified Scheffe's Multiple Range Test (Guenther, 1964) was used to obtain groupings of similar soils for each of K_S, SSI_F and SSI_K. Regression analysis was used to test the similarity of results between the three methods of measurement. Regression and correlation techniques were also used to evaluate the relative importance of selected soil parameters on K_S, SSI_F and SSI_K.

Saturated Hydraulic Conductivity

At ten sites it was possible to obtain a K_S measurement for both the summer and Fall seasons. Most sites were too wet in the spring to allow the use of the permeameter so spring measurements have been excluded from statistical analysis. The analysis of variance (Table 17) shows that, for the sites measured, there was no overall difference in K_S between seasons. There were, however, significant differences between sites and the interaction between site and season was also significant. A further examination of the data (Table 18) and the use of Scheffe's Multiple Range Test shows that Site 3.3 had a significant difference between the summer and Fall measurements. It is also probable that this site is the reason for the significant interaction term. The extremely low K_S value obtained at Site 3.3 in the summer coincides with high bulk density measurements at that time. It is possible that soil compaction occurred when white beans were sown in the fields in June. Presumably the surface soil had returned to 'normal' at the time of the fall measurements because bulk density values had fallen and K_S values had risen.

Table 19 is a final grouping of all the sites where it was possible to obtain K_S values for at least one season. No soils in AG-10 are represented because of cracking in the surface horizon of these clayey soils. Similar problems were encountered at Site 1.1 where it was possible to record only two observations. Three groups of soils appear in the fifteen sites analysed (Site 3.3 was counted twice

because of the seasonal differences). The soils with the fastest K_S are Sites 1.2 to 13.1 inclusive, Site 13.3 is alone in an intermediate category and Sites 3.3 (summer), 3.1 and 1.1 fall into the slowest category.

TABLE 17 - Log_{10}, K_s (cm/hr): Analysis of Variance

Source of Variation	SS	DF	MS	F
Main Effects	3.835	10	0.884	13.3*
site	8.796	9	0.977	14.7*
season	0.042	1	0.042	0.6
Interaction	3.907	9	0.434	6.5*
Explained	12.743	19	0.671	10.1*
Residual	3.784	57	0.066	
Total	16.527	76		

* Significant at P<0.05

TABLE 18 - Log_{10} K_S (cm/hr); Comparison of Summer and Fall Values

Site	Summer Mean	N[1]	Fall Mean	N[1]	Scheffe[2]
1.2	1.410	3	1.221	3	NS
3.2	0.977	6	0.561	3	NS
3.3	0.200	4	1.079	3	S
4.1	1.443	5	1.054	3	NS
4.2	0.992	3	0.885	3	NS
5.1	1.172	3	1.108	3	NS
5.2	1.099	3	1.485	3	NS
5.3	0.904	9	1.109	2	NS
13.2	0.893	6	0.987	6	NS
13.3	0.327	3	0.045	3	NS
Mean	0.906	45	0.952	32	NS

1 number of observations in the mean

2 nonsignificant (NS) or significant (S) difference between summer and fall means at $P<0.05$ using a modified Sheffe's Multiple Range Test

TABLE 19 - Log_{10} K_s (cm/hr): Final Groupings

Site	$\bar{X}$	N	
1.2	1.316	6	a*
4.3	1.303	3	a
4.1	1.300	8	a
5.2	1.292	6	a
5.1	1.140	6	a
3.3 fall	1.079	3	a b
5.3	0.942	11	a
13.2	0.940	12	a
4.2	0.939	6	a b
3.2	0.838	9	a b
13.1	0.810	3	a b
13.3	0.186	6	b c
3.3 summer	-0.200	4	c
3.1	-0.388	5	c
1.1	-0.833	2	c

* means followed by the same letter are not significantly different at $P<0.05$ using a modified Scheffe's Multiple Range Test

Steady State Infiltration, Falling Head (SSIF)

At ten sites it was possible to obtain SSI_F measurements for at least two seasons. Values are missing for the spring measurements of sites 1.2, 4.1 and 5.1 because the sites were moved from their original locations. Sites 13.3 (summer) and 4.3 (Fall) had extremely high variances which violated the assumption of homogeneity of variance for most statistical analysis. As a result, those observations were dropped from further analysis. Site 4.3 received heavy traffic when manure was spread on the field prior to the fall measurements. This would explain the variable results at that time. It is possible that a similar explanation exists for the 13.3 summer measurement because the site was located near a pathway between a field of tomatoes and of soybeans.

The analysis of variance (Table 20) showed significant overall differences between seasons and sites. The interaction between site and season was also significant. Explanations of these results can be facilitated by an examination of Table 21 which compares spring, summer and Fall values of SSI_F. The overall seasonal means show a tendency for values to be similar in spring and fall but significantly higher in summer. However, the presence of missing cells in the data matrix confuses the issue because a site with otherwise low values is missing in the summer (thus tending to inflate overall summer mean) and sites with otherwise high infiltration values are missing in the spring and fall (thus tending to deflate the overall spring and Fall means). Interpreted in this light, it is possible that there is, in fact, no significant difference between overall seasonal means. This suggestion is further borne out by the fact that the Scheffe procedure could find only one site, 13.1, where a seasonal difference was significant. The significant interaction term was a result of the anomaly at Site 13.1 and also because the rates of change between seasons was not constant at all sites.

Table 22 is a presentation of the overall site means for SSI_F based on the assumption that only Site 13.1 had significantly different seasonal values. The sites could be arbitrarily divided into three groups (A, Sites 4.1 to 13.1; B, Sites 10.1 to 4.2; C, Sites 13.1 to 3.1). however, the data suggest a continuum of infiltration rates rather than discreet groupings.

TABLE 20 - Log_{10} SSI_F (cm/hr): Analysis of Variance

Source of Variance	SS	DF	MS	F
Main Effects	20.158	11	1.833	74.0*
site	18.465	9	2.052	82.8*
season	1.037	2	0.519	20.9*
Interaction	3.148	13	0,242	9.8
Explained	23.306	24	0.971	39.2
Residual	1.561	63	0.025	
Total	24.866	87	0.286	

* significant at P<0.05

TABLE 21 - Log_{10} SSI_F (cm/hr): Comparison of Spring, Summer and Fall Values

Site	Spring	N[1]	Summer	N	Fall	N	Scheffe[2]
1.1	0.138	3	-0.161	3	-0.296	3	NS
1.2	-	0	1.294	3	1.457	3	NS
4.1	-	0	1.919	3	1.170	3	NS
4.3	1.327	11	1.486	3	-	0	NS
5.1	-	0	1.192	3	1.076	3	NS
5.2	1.550	2	1.447	3	1.205	3	NS
5.3	0.526	3	0.578	3	0.857	2	NS
13.1	0.038	3[a]	1.064	3[b]	0.846	3[ab]	S
13.2	0.623	11	1.128	3	1.063	3	NS
13.3	0.410	3	-	0	0.552	3	NS
Mean	0.837	36[a]	1.105	27[b]	0.882	26[a]	S

1 number of observations in each mean

2 Scheffe's Multiple Range - significant (S) or nonsignificant at $P<0.05$. Row means followed by the same letter are not significantly different at $P<0.05$

TABLE 22 - Log_{10} SSIF (cm/hr): Final Grouping

Site	$\bar{X}$	N	
4.1	1.545	6	a*
1.2 (summer, fall)	1.376	6	a b
4.3	1.361	14	a b
5.2	1,382	8	a b
3.2	1.266	8	a b
5.1	1.134	6	a b
3.3	0.988	7	a b c
13.1 (summer, fall)	0.955	6	a b c
10.1	0.804	4	a b c d
13.2	0.790	17	a b c d
5.3	0.628	8	b c d
13.3	0.481	6	b c d
10.2	0.178	4	c d
4.2	0.129	2	c d
13.1 (spring)	0.038	3	d
1.1	-0.106	9	d
3.1	-0.280	3	d

* Means followed by the same letter are not significantly different at P<0.05 using a modified Scheffe's Multiple Range Test

Steady State Infiltration, Constant Head (SSIK)

Summer and fall measurements of SSI_K were obtained at six of the sixteen sites.Two additional sites, 10.1 and 10,3, were measured only in the fall because large cracks in the soil made summer measurements impractical due to the large volumes of water required to achieve steady state.

Analysis of variance of the SSI_K data (Table 23) showed significant interaction between the two main effects. The seasonal difference was caused mainly by the large difference at Site 1.1 between summer and fall values. The interaction term is significant for the same reason. Site 1.1 is a clayey soil and develops large cracks on drying. Some of these macro-pores were observed to be continuous from the surface to a depth of 100cm or more in soil pits. Cracks were avoided when performing infiltration because of the large volumes of water required to achieve steady state. In the fall it was not possible to avoid all cracks because partial swelling made them undetectable to the eye. Thus, it may be possible that the fall measurement is a better estimate of the infiltration rate at Site 1.1 than the summer measurement.

No other sites showed significant seasonal differences, therefore Table 25 was prepared to show average SSIK values for ten sites (Site 1.1 was included twice to allow for seasonal differences). Three groups of soils can be discerned (A, 10.2-1.1; B, 13.2-3.2; C, 1.1-3.1) but the data suggest a continuum of infiltration rates rather than discreet groups of soils.

TABLE 23 - Log10 SSI_K (cm/hr): Analysis of Variance

Source of Variation	SS	DF	MS	F
Main Effects	12.144	6	2.024	29.2*
site	11.635	5	2.327	33.6*
season	0.701	1	0.701	10.1*
Interaction	4.894	5	0.979	14.1*
Explained	17.038	11	1.549	22.3*
Residual	3.814	55	0.069	
Total	20.851	66	0.316	

* significant at $P<0.05$

TABLE 24 - Log_{10} SSI_K (cm/hr): Comparison of Summer and Fall Values

Site	Summer	N[1]	Fall	N	Scheffe[2]
1.1	-0.451	3	0.971	3	S
3.1	-0.550	3	-0.371	3	NS
3.2	0.186	6	0.905	4	NS
3.3	1.000	6	1.198	6	NS
5.3	0.739	9	0.194	6	NS
13.2	0.759	12	0.907	6	NS
Mean	0.510	39	0.686	28	S
Mean (excluding Site 1.1)	0.589	36	0.652	25	NS

1 Number of observations in each mean

2 Significant (S) or nonsignificant (NS) difference at $P<0.05$ using a modified version of Scheffe's Multiple Range Test

TABLE 25 - Log_{10} SSI_K (cm/hr): Final Groupings

Site		$\bar{X}$	N
10.2	(fall)	1.379	3 a*
10	(fall)	1.372	3 a
3.3		1.099	12 a
1.1	(fall)	0.971	3 a b
13.2		0.808	18 a b
4.3	(fall)	0.566	3 a b
5.3		0.521	15 a b
3.2		0.474	10 b
1.1	(sum	-0.451	3 c
3.1		-0.461	6 c

* means followed by the same letter are not significantly different at P<0.05 using a modified version of Scheffe's Multiple Range Test

Soil Variables Influencing the Rate of Water Entry Into Soil

Nine variables were chosen to be used in predicting each of K_S, SSI_F and SSI_K. These variables are listed in Table 26 which shows how well each parameter correlates with water entry measurements. Variables dealing with soil compaction - bulk density and porosity - are significantly correlated with SSI_F and K_S. None of the variables are well correlated with SSI_K. However, structure and texture seem to have a greater effect on SSI_K than either SSI_F or K_S. The constant head procedure also seems to be more sensitive to initial moisture conditions than the other two methods.

Stepwise multiple regressions were used to quantify the relationships obtained in the correlation procedure. No equation admitted more than one variable because of collinearity problems. Second and third order equations gave no improvement over the first order equations. All equations give entry rates in cm/hr.

Log_{10} Ks can be predicted by either of the two following equations:

$$Log_{10} K_s = -2.927 + 0.080 \text{ total pore space (\%)}$$
$$Log_{10} K_s = 4.472 - 2.710 \text{ dry bulk density}$$

The equations produce R^2 values of 0.34 and 0.31 respectively. Both are based on 24 pairs of observations.

$Log_{10} SSI_F$ can be predicted from either of the following two equations:

$$Log_{10} SSIF = 4.671 - 2.777 \text{ dry bulk density}$$
$$Log_{10} SS_{IF} = -1.765 + 0.0574 \text{ total pore space (\%)}$$

Based on 25 pairs of observations, the equations produce R^2 values of 0.29 and 0.23 respectively.

No equation significant at $P<0.05$ was developed for the prediction of SSI_K.

TABLE 26 - Correlation Matrix: K_S, SSI_F and SSI_K vs Selected Soil Properties

Variable	K_S (24)+	SSI_F (25)	SSI_K (15)
dry bulk density	-0.56*	-0.54*	-0.06
wet bulk density	-0.41*	-0.48*	-0.31
total pore space	0.58*	0.47	0.04
mass wetness	0.14	0.12	-0.22
degree of saturation	-0.11	-0.17	-0.24
% of sand	-0.13	-0.19	0.26
% clay	-0.06	0.01	-0.21
% silt and very fine sand	0.11	0.25	-0.17
grade of structure	0.21	-0.01	0.17

\+ bracketed number is the number of observations

* significant at $P<0.05$

A Comparison of Values Obtained by the Three Methods

Linear regression was used to compare the values obtained for K_S, SSI_F and SSI_K where at least two measurements were available for a single site. Three pairwise comparisons were made - K_S vs SSI_F, K_S vs SSI_K and SSI_K vs SSI_F. Sites that displayed significant seasonal changes as measured by any of the methods were not included in this analysis.

The relationship between K_S and SSI_F is approximated by the equation:

$$\log_{10} K_S = -0.02 + 0.95 \log_{10} SSI_F$$

The regression is based on 12 pairs of observations and produces an R^2 value of 0.71; F-ratio, 24.9; significant at $P<0.05$.

The relationship between Ks and SSI_K is approximated by the equation:

$$\log_{10} K_S = 0.11 + 1.48 \log_{10} SSI_K$$

This regression is based on six pairs of observations and produces an R^2 value of .90; F-ratio, 35.6; significant at $P<0.05$. This relationship is not as close to 1:1 as is K_S vs SSI_F. The constant head apparatus appears to produce lower values of water entry when compared to the other methods. 0ne possible explaination is related to the fact that the constant head method generally uses more water than the other methods, thus forcing the wetting front to greater soil depths where water movement is slower.

The relationship between SSI_F and SSI_K was judged to be nonsignificant at $P<0.05$ ($r=0.51$) based on nine pairs of observations. This conclusion is an apparent contradiction of the first two equations (ie since K_S is similar to both SSI_F and SSI_K, then SSI_F and SSI_K should be similar to each other). A possible explaination may be related to the fact that SSI_F and SSI_K measurements were never concurrent. Minor changes in soil conditions over time may be masking a true correlation between the two methods of measurement.

CONCLUSIONS

(1) the soil inventory of the six detailed agricultural subwatersheds was completed and the information is displayed at a scale of 1:25,000. Results of the detailed inventory were compared to results presented on reconnaissance county soil survey maps published at a scale of 1:63,360. In general, the 1:25,000 maps show a greater proportion of poorly drained soils than the county maps. This trend is particularly evident in AC-3, 4, 5 and 10. The reason for the difference is twofold. Firstly, intricate soil patterns such as found in these areas become easier to depict accurately as the scale becomes larger. Secondly, the method of identifying delineations on the detailed maps allows two soils to be shown in the same unit instead of only one soil as in the county reports. The more modern method simplifies the task of describing intricate soil patterns and estimating the extent of each soil series over the mapping area.

Changes in the concepts of some soil series account for some discrepencies between the two sets of maps. This is the case particularly in AG-1, 5 and 13. The changes in AG-1 and 5 were relatively minor and have little effect on most interpretative groupings. however, there were significant changes in AC-13. The parent material of the Berrien Series used to be defined as 90-180 cm of sandy over clayey parent material. The accepted depth criteria are presently 50-100 cm. 0ther changes in AC-13 include the recognition of a larger extent of soils developed from laminated very fine sand and silt.

The differences noted above are of particular importance in the extrapolation of subwatershed data to larger drainage basins.

(2) The rate of water entry into the surface horizon was measured for the major soils of each subwatershed. None of the three methods employed were able to detect a consistant pattern in water entry rates on a seasonal basis although there was a tendency for SSI_F values to be higher in the summer than in the spring or fall.

Groupings of soils were produced using a modified version of Scheffe's Multiple Range Test. The groupings were very broad with large overlaps between groups. Correlation and regression analysis showed that bulk density and porosity were the most important soil factors in predicting K_S and SSI_F values. Bulk density, structural and textural soil properties showed the highest correlation with SSI_k but none of the r values were significant at $P<0.05$.

Correlation and regression techniques were also used to show the relationship between Ks, SSI_F and SSI_K. K_S and SSI_F showed a nearly 1:1 relationship. SSI_K values were consistently lower than K_S values and were not significantly correlated with SSI_F. The SSI_K vs SSI_F relationship may have been masked by the fact that the two values were never measured concurrently at the same site.

(3) The soil series identified in each subwatershed were interpreted for their agricultural capability and for their inherent potential to transmit pollutants to groundwater and surface water systems. The majority of the soils inventoried were either Class 1 or 2 for agriculture. Slight restrictions due to wetness, topography, undesirable structure or fertility were the most common limitations encountered. Significant areas of Class 3 soils occurred in AG-10 and 13, due to wetness limitations.

AG-1 was found to be comprised almost exlusively of Group V soils when considered for pollutant transfer potential. The soils of AG-3, 4 and 10 were mainly Group I with significant amounts of Group V. Group II, IV and V soils were approximately equally distributed in AG-5. AG-13 soils were mainly Group II, III and V.

RELATIONSHIP OF PROJECT RESULTS TO PLUARG OBJECTIVES

The results of this project will, in part, facilitate the extrapolation of detailed subwatershed data to entire drainage basins. Soil map users should be aware that, in many cases, the extent of poorly drained soils is underestimated in the reconnaissance soil survey reports published on a county basis. The results obtained in AG-3, 4, 5 and 10 are evidence of this trend. Users should also be aware that the concepts of some soil series have changed significantly over time. The Berrien Series is one example of this situation. 0lder surveys define the parent material of the Berrien Series as 90-180 cm of sandy over clayey material. The modern definition is 50-100 cm of sandy over clayey material.

Interpretative soil groupings were prepared to predict the potential of various soils to transmit pollutants to surface and groundwater systems. These groupings were based on the principle that deep well drained medium textured soils on gentle slopes have the greatest potential to absorb most pollutants. Increasing shallowness, steeper slopes and poorer natural drainage tend to reduce this capacity.

This study was also intended to provide input to other PLUARG investigations. Samples of major soils were provided to investigators involved in Projects 8, 9, 10 and 11.

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TABLE 27: DATA CHECKLIST

SERIES	SITE #	SITE DESC (APP I)	ANAL DATA (APP II)	ENG DATA (APP III)	MINERALOGY (APP IV)	WATER TRANS (pp 74-89
005	-					
013	4.4	X	X		X	
015	-					
024	4.3	X	X	X	X	X
	4.6	X	X		X	
025	4.2	X	X	X	X	X
	4.5	X	X		X	
026	4.1	X	X	X	X	X
037	-					
043	5.2	X	X	X	X	X
	5.6	X	X		X	
045	5.3	X	X	X	X	X
	5.4	X	X		X	
046	5.1	X	X	X	X	X
053	5.5	X	X		X	
055	-					
056	-					
067	-					
077	-					
083	-					
093	-					
095	13.4	X	X		X	
096	-					
103	-					
105	13.2	X	X	X	X	X
106	-					
115	-					
115s	13.1	X	X	X	X	X
	13.3	X	X	X	X	X
116	-					
125	-					
126	-					
136	-					
147	-					

TABLE 27: cont'd

SERIES	SITE #	SITE DESC (APP I)	ANAL DATA (APP II)	ENG DATA (APP III)	MINERALOGY (APP IV)	WATER TRANS (pp74-89)
153	-					
165	1.3	X	X			
175	1.7	X	X			
175g	1.5	X	X			
176	1.1	X	X	X	X	X
	1.2	X	X	X	X	X
	1.6	X	X			
176s	1.4	X	X			
183	-					
185	-					
195	-					
206	3.5	X	X			
216	3.7	X	X			
223	-					
225	3.4	X	X			
226	3.1	X	X	X	X	X
234	3.3	X	X	X	X	X
	3.6					
235	3.2	X	X	X	X	X
236	-					
247	-					
253	-					
255	10.5	X	X			
256	-					
264	10.4	X	X			
265	10.2	X	X	X	X	X
	10.3	X	X			
	10.6	X	X			
266	10.1	X	X	X	X	X

APPENDIX I

SITE AND PROFILE DESCRIPTION OF MAJOR SOIL SERIES

Appendix I contains site and profile descriptions of the major soil series encountered in all of the detailed subwatersheds. Routine analytical data for these sites are presented in Appendix II. Additional data for selected sites are contained in Appendices III and IV.

All sites from AG-1 are prefixed with the numeral 1; sites from AG-3 with the numeral 3, etc. Sites are listed in the sequence of subwatershed number. Locations are given by quoting the military grid reference on the appropriate NTS topographic sheet. Sample site locations are also marked on the soils maps of the subwatershed.

Terminology at the Order, Great Group and Subgroup levels is consistent with the 1974 edition of the System of Soil Classification for Canada. Soil family terminology has been modified to correspond to the 1978 System. The soil series numbers used are unique to this report.

SERIES 176

SITE DESCRIPTION — DATE OF SAMPLING: Oct. 29, 1975

SITE NUMBER:	1.1
LOCATION:	40J/2h737695
SURFACE FORM:	level
SLOPE:	simple 0.3% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	slowly pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	soybeans (harvested and plowed)
COMMENTS:	The calcium carbonate equivalent reported for the Ckg horizon at this site is 10-15% lower than is normally expected for this series.

CLASSIFICATION

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine clayey, strong calcareous, mild, subaquic

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-16 (14-20)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR6/2d); clay loam; moderate fine subangular blocky breaking to moderate to strong medium granular; sticky, firm, very hard, plastic; clear smooth boundary; some angular gravel, chert and shale.
Bg_1	16-45 (20-30)	Gray (10YR5.5/1m), light gray (10YR7/1d); clay; many medium prominent strong brown (7.5YR5/6) mottles; strong medium breaking to fine subangular blocky structure; very sticky, very firm, extremely hard, very plastic; diffuse wavy boundary; many thick clay films on ped faces; some angular gravel, chert, shale and cobbles.

Site 1.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Bg_2	45-116 (60-80)	Gray (10YR5.5/1m), light gray (10YR7/1d); clay; many coarse prominent strong brown (10YR5/6) mottles; moderate to strong coarse breaking to medium subangular blocky; very sticky, very firm, extremely hard, very plastic; gradual wavy boundary; common moderately thick clay films on ped faces; some angular gravel, chert, shale and cobbles.
Ckg	116+	Gray (10YR6/1m), light gray (10YR7/1d); clay and clay loam; many coarse prominent strong brown (10YR5/6) mottles; moderate to strong coarse subangular blocky; very sticky, very firm, extremely hard, very plastic; moderate effervescence with 10% HCL; some angular gravel, chert, shale and cobbles.

SERIES 176 - Textural Variant

SITE DESCRIPTION: DATE OF SAMPLING: Oct. 30, 1975

SITE NUMBER:	1.2
LOCATION:	40J/2h729681
SURFACE FORK:	level
SLOPE:	simple 0.3% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	wheat harvested in August, presently fallow
COMMENTS:	This site represents an intergrade between Series 176 and Series 176s.Under virgin conditions there was most likely a thin (<10 cm) discontinuous to overburden of sand at the site.Cultivation mixed the sand with the clay beneath resulting in a clay loam to loam textured surface.

CLASSIFICATION:

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGR0UP:	Orthic Humic Gleysol
FAMILY:	Fine clayey, alkaline, strongly calcareous, mild, subaquic

HORIZON	MODAL DEPTH	DESCRIPTION
Ap	0-30 (28-32)	Very dark grayish brown (10YR3/2m) light brownish gray (10YR5.5/2d); clay loam; moderate medium granular; slightly sticky, friable, hard, slightly plastic; abrupt, smooth boundary; some gravel.
Bg	30-60 (5-33)	Gray (10YR5/1m), white(10YR8/2d); clay loam; many coarse prominent yellowish brown (10YR5/6) mottles; moderate medium to coarse subangular blocky; sticky, firm, extremely hard, very plastic; gradual wavy boundary; many moderately thick clay films on ped faces; some gravel, angular gravel, shale and cobbles.

Site 1.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckg	60+	Gray(10YR5/1m), white(10YR8/2d), silt clay loam and silty clay; common coarse prominent yellowish brown (10YR5/6) mottles; moderate to strong coarse subangular blocky;sticky, firm, extremely hard, very plastic; moderately effervescent with 10% HCL; some gravel, angular gravel, shale and cobbles.

SERIES 165

SITE DESCRIPTION — DATE OF SAMPLING: April 19, 1976

SITE NUMBER:	1.3
LOCATION:	40J/2h754646
SURFACE FORM:	level with broad, low hummocks
SLOPE:	upper portion of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	fallow
COMMENTS:	remnants of Brunisolic development in Aegj horizon present.

CLASSIFICATI0N

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisolic
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Coarse loamy over fine clayey, strongly

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-28 (26-33)	Dark grayish brown (10YR4/2m), light brownish gray (10YR6/2d); loamy sand; weak medium angular blocky, breaking to very weak medium granular; slightly sticky, very friable, soft, nonplastic; abrupt smooth boundary; some gravel.
Aegj	28-36 (0-20)	Yellowish brown (10YR5/4m), very pale yellow (10YR7/4); sand; common medium distinct yellowish brown (10YR5/6) mottles; single grain (structureless); nonsticky, loose; nonplastic; abrupt broken boundary; some gravel.
Btgj	36-60 (13-40)	Dark yellowish brown (10YR4/4m) drying to pale brown (10YR6/3d); fine sandy loam; common medium distinct yellowish brown (10YR5/6) mottles; weak coarse angular blocky; slightly sticky, very friable, slightly hard, nonplastic; abrupt wavy

Site 1.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj -	cont'd	boundary; common thin dark yellowish brown clay films in many voids/channels and on some vertical and horizontal ped faces; some gravel.
II Ckg	60+	Gray (10YR6/1m) drying to light gray (5YR7/1d); silty clay; many coarse prominent dark yellowish brown (10YR4/6) mottles; strong medium to coarse angular blocky, very sticky, very firm, very hard, very plastic; moderately effervescent; some angular gravel and shale.

SERIES 176s

SITE DESCRIPTION DATE OF SAMPLING: April 19, 1976

SITE NUMBER:	1.4
LOCATION:	40J/2h754646
SURFACE FORM:	level
SLOPE:	toe of simple 1% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	fallow
COMMENTS:	watertable at 1.2m

CLASSIFICATION

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine clayey, alkaline, strongly calcareous, mild, subaquic

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-22 (20-34)	Very dark gray (10YR3/1m), grayish brown (10YR5/2d); fine sandy loam; weak medium angular blocky breaking to weak medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt smooth boundary; some gravel
Bg	22-47 (0-27)	Brown (10YR5/3m), grayish brown (10YR5/2d); fine sandy loam; many medium prominent yellowish brown (10YR5/6) mottles; weak coarse angular blocky breaking to weak medium granular; slightly sticky, very friable, soft, slightly plastic; clear broken boundary; some gravel and shale.
II Bg	47-95 (40-70)	Gray (10YR5/1m), light gray (10YR6/1d); clay loam and clay; many medium prominent dark yellowish brown (10YR4/4) mottles; strong coarse angular blocky; sticky, firm, very hard, very plastic; gradual wavy boundary; some angular gravel, shale and cobbles.

Site 1.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
II Ckg	95+	Dark gray (10YR4/1m), light brownish gray (10YR6/2d); clay loam and silty clay loam; many coarse prominent dark yellowish brown (10YR4/4) mottles; strong coarse angular blocky; sticky, firm, very hard, very plastic; moderately effervescent with 10% HCL; some angular gravel, shale

SERIES 175g

SITE DESCRIPTION DATE OF SAMPLING: April 22, 1976

SITE NUMBER: 1.5

LOCATION: 40J/2h715694

SURFACE FORM: level with low hummocks

SLOPE: lower portion of simple 1% slope

DRAINAGE: imperfectly drained

PERVIOUSNESS: moderately pervious

EROSION: slight

STONINESS: slightly stony

PRESENT LAND USE: fallow

COMMENTS: The II Btgj horizon replaces the Btgj on 70% of theexposed surface.

CLASSIFICATION

ORDER: Luvisolic

GREAT GROUP: Gray Brown Luvisol

SUBGROUP: Gleyed Orthic Gray Brown Luvisol

FAMILY: Fine clayey, strongly calcareous, mild,subhumid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-20 (17-22)	Dark grayish brown (10Y R4/2m) light brownish gray (10YR6/2d); sandy loam; weak coarse angular blocky breaking to weak coarse granular; slightly sticky, very friable, soft, nonplastic; abrupt smooth boundary; gravel and some chert.
Aegj	20-28 (6-17)	Brownish yellow (10YR6/6m), very pale brown (10YR7/3d); gravelly sandy loam; common medium distinct reddish yellow (7.5YR6/8) mottles; weak medium angular blocky; slightly sticky, friable, slightly hard, slightly plastic; clear, irregular boundary; gravel
Btgj	28-54 (0-30)	Dark yellowish brown (10YR4/4m), light yellowish brown (10YR6/4d); gravelly sandy clay loam; few medium distinct dark yellowish brown (10YR4/6) mottles; moderate medium

Site 1.5 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj -	cont'd	subangular blocky; slightly sticky, friable, hard, plastic; clear, broken boundary; moderately thick, dark yellowish brown (10YR4/4m) clay skins in many voids/channels on some vertical and horizontal ped faces; gravel, some chert and cobbles.
II Btgj	28-54 (0-30)	Yellowish brown (10YR5/4m) , pale brown (10YR6/3d); silty clay; common medium distinct strong brown (7.5Y R5/6) mottles; moderate to strong fine to medium angular blocky; sticky, very firm, hard, very plastic; clear, broken boundary; many thick brown (10Y R5/3m) clay films in all voids/ channels and on all vertical and horizontal ped faces; some shale and cobbles.
II Ckg	54+	Gray (5Y6/1m), white (10YR8/2d); silty clay loam; many coarse prominent yellowish brown (10Y R5/6) mottles; strong coarse angular blocky; sticky, firm, very hard, very plastic; moderately effervescent with 10% HCL; some shale and cobbles.

SERIES 176

SITE DESCRIPTION — DATE OF SAMPLING: Sept. 16, 1976

SITE NUMBER: 1.6

LOCATION: 40J/2h747652

SURFACE FORM: level

SLOPE: simple 0.3 slope

DRAINAGE: poorly drained

PERVIOUSNESS: slowly pervious

EROSION: slight

STONINESS: nonstony

PRESENT LAND USE: snap beans - harvested and fall plowed

CLASSIFICATION

ORDER: Gleysolic

GREAT GROUP: Humic Gleysol

SUBGROUP: Orthic Humic Gleysol

FAMILY: Fine clayey, alkaline, strongly calcareous, mild, subaquic.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-25 (24-27)	Very dark grayish brown (10YR3/2m), brown (10YR5/3d); clay loam; weak medium angular blocky breaking to strong medium granular; slightly sticky, firm, hard, slightly plastic; abrupt smooth boundary; some angular gravel and shale.
Bg_1	25-75 (40-50)	Gray (10YR5/1m); clay; many medium prominent yellowish brown (10YR5/8) mottles; strong medium angular blocky breaking to strong fine angular blocky; sticky, firm, very hard, plastic; diffuse wavy boundary; many thick clay films on ped faces; some angular gravel and shale.
Bg_2	75-100 (20-30)	Gray (10YR5.5/1m); clay; many coarse prominent yellowish brown (10YR5/8) mottles; strong coarse angular blocky breaking to strong fine angular blocky; sticky, firm, very hard, plastic; clear wavy boundary, common thick clay films on ped surfaces; some angular gravel and shale.

Site 1.6 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckg	100+	Light gray (10YR6/1m); silty clay; prominent dark yellowish brown (10YR4/4) mottles; moderate coarse angular blocky breaking to strong fine angular blocky; sticky, firm, very hard, plastic; moderate effervescence with 10% HCL; some angular gravel and shale.

SERIES 175

SITE DESCRIPTION DATE OF SAMPLING: Sept.16,1977

SITE NUMBER: 1.7

LOCATION: 40J/2h751693

SURFACE FORM: level

SLOPE: upper part simple 1.5% slope

DRAINAGE: imperfectly drained

PERVIOUSNESS: slowly pervious

EROSION: slight

STONINESS: slightly stony

PRESENT LAND USE: fallow

CLASSIFICATION

ORDER: Luvisolic

GREAT GROUP: Gray Brown Luvisol

SUBGROUP: Gleyed Orthic Gray Brown Luvisol

FAMILY: Fine clayey, strongly calcareous, mild, subhumid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-20 (18-20)	Dark grayish brown (10YR4/2m); loam; moderate to strong medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; some angular gravel, chert and shale.
Aegj	20-22 (0-9)	Yellowish brown (10YR5/4m); loam; common medium distinct strong brown (7.5YR5/6) mottles; weak to moderate medium granular; slightly sticky, very friable, slightly hard, slightly plastic; abrupt broken boundary; some angular gravel, chert and shale.
Btgj	22-50 (24-35)	Grayish brown (10YR5/2); clay; common medium distinct dark yellowish brown (10YR4/4) mottles, few fine prominent dark yellowish brown (10YR4/6) mottles; moderate medium prismatic breaking to strong medium angular blocky; sticky, firm, hard, plastic; clear, wavy boundary; common, moderately thick clay films in many voids/channels and some vertical and horizontal ped faces; some angular

SITE 1.7 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckgj	50+	Grayish (10YR5/2m) matrix; silty clay loam; common coarse distinct yellowish brown (10YR5/4) mottles; strong medium angular blocky; sticky, firm, hard, plastic; some angular gravel, chert and shale.

SERIES 226

SITE DESCRIPTION DATE OF SAMPLING: Sept. 10, 1976

SITE NUMBER: 3.1

LOCATION: 40P/6W687980

SURFACE FORM: level blanket

SLOPE: depressional complex 1% slope

DRAINAGE: poorly drained

PERVIOUSNESS: moderately pervious

EROSION: nil

STONINESS: nonstony

PRESENT LAND USE: white beans

COMMENTS: Discontinuous gravel layer at till contact

CLASSIFICATION

ORDER: Gleysolic

GREAT GROUP: Humic Gleysol

SUBGROUP: Orthic humic Gleysol

FAMILY: Fine clayey, alkaline, extremely calcareous, mild, subaquic

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-30 (25-35)	Very dark grayish brown (10YR3/2m), grayish brown (10YR5/2d); silty clay loam; moderate medium granular; sticky, friable, slightly hard, plastic; abrupt smooth boundary; free of coarse fragments.
Bg_1	30-45 (10-20)	Brown (10YR5/3m); silty clay loam; many prominent yellowish brown (10YR5/6) mottles; moderate to strong medium subangular blocky; sticky, firm, very hard, very plastic; granular wavy boundary; common moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; free of coarse fragments.
Bg_2	45-70 (30-40)	Grayish brown (10YR5/2m); silty clay; many coarse prominent yellowish brown (10YR5/6) mottles; moderate medium subangular blocky; sticky,firm, very hard, very plastic; clear wavy boundary; common moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; free of coarse fragments.

SITE 3.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
II Ckg	70+	Yellowish brown (10YR5/4m); silty clay loam many coarse prominent reddish yellow (7.5YR6/8) mottles; moderate medium subangular blocky; sticky, friable, extremely hard, very plastic; moderately effervescent with 10% HCL; some angular gravel, shale and cobbles.

SERIES 235

SITE DESCRIPTION	DATE OF SAMPLING: May 12, 1976
SITE NUMBER:	3.2
LOCATION:	40P/6686980
SURFACE FORM:	level
SLOPE:	toe of complex 1% slope
DRAINAGE:	imperfectly drained
PREVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	fallow (in preparation for white beans)
COMMENTS:	water table at 0.7m
CLASSIFICATION	
ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, extremely calcareous, mild, humid

HORIZON	MODAL DEPTH (cm)	DESCRIPTION
Ap	0-26	Very dark grayish brown (10YR3/2m), grayish brown (10YR5/2d);silty clay loam; weak to moderate medium to coarse subangular blocky breaking to moderate medium granular; sticky, friable, hard, plastic; abrupt wavy boundary; few very fine random roots inped and exped; common fine vertical exped continuous dendritic interstitial pores, many very fine random inped discontinuous simple tubular pores; few fine dark gray (10YR4/1m) oblong worm casts throughout matrix; some angular gravel, shale and cobbles.
Aegj	26-37	Dark brown to brown (10YR4/3m); silty clay loam; common fine distinct yellowish brown (10YR5/5) mottles; weak medium to coarse subangular blocky breaking to weak to moderate fine to medium subangular blocky; sticky, friable, hard, plastic; clear broken boundary; few very fine random inped and exped roots common fine vertical exped continuous dendritic

SITE 3.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Aegj - cont'd		interstitial pores, many very fine random inped discontinuous simple tubular pores; common fine dark gray (10YR4/1) worm casts throughout matrix; some angular gravel, shale and cobbles.
$Btgj_1$	37-47	Dark grayish brown (10YR4/2m), brown (10YR4.5/3.5d); silty clay; few fine distinct dark yellowish brown (10YR4/4) mottles; weak to moderate medium subangular blocky breaking to weak to moderate fine to medium subangular blocky; sticky, friable, hard, plastic; clear wavy boundary; many thin clay films in many voids/channels and on some vertical and horizontal ped faces; few very fine random inped and exped roots; common fine vertical exped continuous dendritic interstitial pores and many very fine random inped discontinuous simple tubular pores; common fine dark gray (10YR4/1m) worm casts throughout matrix; some angular gravel, shale and cobbles.
$Btgj_2$	47-52 (4-30)	Brown to dark brown (10YR4/3m), pale brown (10YR6/3d); silty clay loam; few fine distinct strong brown (7.5YR5/5) mottles; weak to moderate medium to coarse subangular blocky breaking to moderate medium subangular blocky; sticky, friable, hard, plastic; clear wavy boundary; many thin clay films in many voids/channels and on some vertical and horizontal ped faces; few very fine random inped and exped roots; common fine vertical exped continuous dendritic interstitial pores, and many very fine random inped discontinuous simple tubular pores; common fine dark gray (10YR4/1m) worm casts throughout matrix; some

SITE 3.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckgj	52+	Brown (10YR5/3m);light gray (10YR7/2d); silty clay loam; many medium prominent strong brown (7.5YR6/6) mottles; moderate medium to coarse subangular blocky breaking to moderate fine to medium angular blocky; sticky, friable, extremely hard, very plastic; very few, very fine random inped and exped roots; common fine vertical exped continuous simple tubular pores; few fine oblong dark gray (10YR4/1m) worm casts throughout matrix; moderately calcareous with 10% HCL; some angular gravel, shale and cobbles.

SERIES 234

SITE DESCRIPTION DATE OF SAMPLING: May 12, 1976

SITE NUMBER:	3.3
LOCATION:	40P/6W685980
SURFACE FORM:	undulating
SLOPE:	upper portion of complex 4% slope
DRAINAGE:	moderately well drained
PERVIOUSNESS:	moderately pervious
EROSION:	moderate water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	fallow (in preparation for white beans)
COMMENTS:	(1) watertable at 0.5m
	(2) in about 30% of exposed profile the BCk horizon

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, extremely calcareous, mild,humid.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-24 (18-27)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR5/2d); silty clay loam and clay loam; moderate to strong medium granular; slightly sticky, very friable, hard, plastic; abrupt smooth boundary; few very fine exped roots; few fine vertical exped continuous dendritic interstitial pores and many very fine random inped discontinuous simple tubular pores; some angular gravel, shale and cobbles.
Ae	24-30 (0-18)	Grayish brown (10YR4.5/3m), light brownish gray (10YR6/3d); silt loam; weak medium to coarse subangular blocky breaking to moderate medium granular; slightly sticky, friable, hard, plastic; abrupt, broken boundary; few very fine random exped roots; common fine vertical exped continuous dendritic interstitial pores and many fine

SITE 3.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ae -- cont'd		random inped discontinuous simple tubular pores; common fine dark grayish brown (10YR4/2m) worm casts throughout matrix; some angular gravel, shale and cobbles.
Bt	30-50 (0-18)	Brown to dark brown (7.5YR4/3m), brown to dark brown (10YR4/3d); clay; strong medium to coarse subangular blocky; very sticky, firm, extremely hard, very plastic; clear broken boundary; continuous moderately thick clay films in all voids/ channels and on all vertical and horizontal ped faces; few very fine random exped roots; common fine random exped, continuous dendritic interstitial pores and many very fine random inped discontinuous simple tubular pores; common fine oblong dark grayish brown (10YR4/2m) worm casts throughout matix; some angular gravel, shale and cobbles.
BCk	50-55 (0-20)	Brown to dark brown (10YR4/3m), brown (10YR 5/3d); silty clay loam, moderate medium to coarse subangular blocky; sticky, firm, very hard, plastic; gradual broken boundary; many thin clay films in many voids/channels and on some vertical and horizontal ped faces; few very fine random exped roots; common fine random exped continuous dendritic interstitial pores and many very fine random inped, discontinuous simple tubular pores; few fine oblong grayish brown (10YR4/2m) worm casts throughout matrix; moderately effervescent with 10% HCL; same angular gravel, shale and cobbles.
Ckgj	55+	Yellowish brown (10YR5/4m), pale brown (10YR 6/3d); silty clay loam; few fine distinct yellowish brown (10YR5/6) mottles; moderate coarse subangular blocky breaking to strong fine subangular blocky; sticky, firm, extremely hard, plastic; very few, very fine random exped roots; common fine random exped continuous dendritic interstitial pores and many very fine inped discontinuous simple tubular pores; few fine oblong grayish brown worm casts throughout matrix; strongly effervescent with 10% HCL; some angular gravel, shale and cobbles.

SERIES 225

SITE DESCRIPTION DATE OF SAMPLING: June 22, 1976

SITE NUMBER:	3.4
LOCATION:	40P/2W679948
SURFACE FORM:	level blanket
SLOPE:	upper portion of complex 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	corn
COMMENTS:	The glaciolacustrine overburden ranged from 30 to over 100 cm in thickness in general vicinity of the sample site. There was often a thin (<10cm) gravelly layer at the till contact.

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine silty, extremely calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-17 (15-20)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR6/2d); silt loam; weak medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt smooth boundary; free of coarse fragments.
Aegj	17-30 (0-30)	Yellowish brown (10YR5/4m), very pale brown (10YR7/3d); silt loam; common medium distinct dark yellowish brown (10YR4/4m) mottles; weak fine subangular blocky breaking to weak to moderate medium granular; slightly sticky, very friable, slightly hard, slightly plastic; clear broken boundary; free of coarse fragments.
Btgj	30-60 (10-40)	Dark yellowish brown (10YR4/4m), very pale brown (10YR7/4d);silty clay loam; common medium distinct yellowish brown (10YR5/6)

SITE 3.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj - cont'd		mottles; moderate to strong medium sub-angular blocky; very sticky, firm, hard, very plastic; clear irregular boundary; common moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; free of coarse fragments.
BCgj	60-80 (5-25)	Dark yellowish brown (10YR4/4m), very pale brown (10YR7/4d); silty clay loam; many medium prominent yellowish brown (10YR5/7) mottles; moderate coarse subangular blocky breaking to moderate medium subangular blocky; sticky, friable, slightly hard, plastic; diffuse wavy boundary; free of coarse fragments.
Ckgj	80-90 (0-15)	Pale brown (10YR6/3m), light gray (10YR7/2d); silt loam; many medium prominent yellowish brown (10YR5/7) mottles; weak medium pseudo-platy breaking to moderate medium angular blocky; sticky, friable, slightly hard, slightly plastic; clear broken boundary; moderate effervescence with 10% HCL; free of coarse fragments.
II Ckgj	90+	Brown (10YR5/3m), pale brown (10YR6/3d); silty clay loam; many coarse prominent dark yellowish brown (10YR4/6) mottles; strong coarse angular blocky; very sticky, friable, extremely hard, very plastic; moderate effervescence with 10% HCL; some angular gravel, shale and chert.

SERIES 206

SITE DESCRIPTION — DATE OF SAMPLING: June 23, 1976

SITE NUMBER:	3.5
LOCATION:	40P/6W656956
SURFACE FORM:	level
SLOPE:	simple 0.3% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	nil
STONINESS:	nonstony
PRESENT LAND USE:	corn

CLASSIFICATION

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Carbonated Orthic Humic Gleysol
FAMILY:	Coarse silty, alkaline, extremely calcareous, mild, subaquic.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Apk	0-25 (20-35)	Very dark gray (10YR3/1m), gray (10YR5/1d); silt loam; weak medium angular blocky breaking to moderate medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt wavy boundary; moderately effervescent; free of coarse fragments.
Bgk_1	25-40 (5-20)	Gray to light gray (5YR6/1m), white (5YR 8/1d); silt loam; few fine prominent dark yellowish brown (10YR4/6) mottles; weak coarse pseudo platy breaking to weak to moderate medium angular blocky; slightly sticky, very friable, soft, slightly plastic; gradual wavy boundary; moderately effervescent; free of coarse fragments.
Bgk_2	45-75 (25-40)	Light olive gray (5YR6/2m), light gray, (5YR7/2d); silt loam; common fine prominent dark yellowish brown (10YR4/6) mottles; weak coarse pseudo-platy breaking to weak to

SITE 3.5 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Egk_2 -	cont'd	moderate coarse angular blocky; slightly sticky, very friable, soft, slightly plastic; gradual wavy boundary; moderately effervescent; free of coarse fragments.
Ckg	75+	Light olive gray (5YR6/2m), light gray (5YR7/2d); silt loam, many coarse prominent yellowish brown (10YR5/8) mottles; weak to moderate coarse pseudo-platy breaking to weak to moderate coarse angular blocky; slightly sticky, very friable, soft, slightly plastic; moderately effervescent; with 10% HCL; free of coarse fragments.

SERIES 234 (Eroded phase)

SITE DESCRIPTION — DATE OF SAMPLING: July 20, 1977

SITE NUMBER:	3.6
LOCATION:	40P/6W701001
SURFACE FORM:	undulating to hummocky
SLOPE:	upper portion of complex 4% slope
DRAINAGE:	moderately well drained
PERVIOUSNESS:	moderately pervious
EROSION:	moderate to severe water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	alfalfa

CLASSIFICATION:

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisoleroded phase
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, extremely calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Apk	0-12 (10-15)	Dark grayish brown (10YR4/2m); silty clay loam; moderate to strong, medium to coarse angular blocky breaking to moderate to strong fine angular blocky; slightly sticky, friable, very hard; abrupt smooth boundary; moderate effervescence with 10% HCL; some angular gravel, shale and cobbles.
Btk	12-25 (0-25)	Dark yellowish brown (10YR3/4m); silty clay; moderate to strong medium subangular blocky breaking to strong fine subangular blocky; sticky, firm, extremely hard; gradual broken boundary; few thin clay films in many voids/ channels and on some vertical and horizontal ped faces; weakly effervescent; some angular gravel, shale and cobbles.

SITE 3.6 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ck	25+	Yellowish brown (10YR5/4m); silty clay loam; moderate to strong medium to coarse subangular blocky breaking to strong medium angular blocky; sticky, firm, extremely hard, very plastic; moderately effervescent; some angular gravel, shale and cobbles.

SERIES 216

SITE DESCRIPTION DATE OF SAMPLING: Oct. 5, 1976

SITE NUMBER:	3.7
LOCATION:	40P/6W709983
SURFACE FORM:	level
SLOPE:	simple <0.5% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	nil
STONINESS:	nonstony
PRESENT LAND USE:	white beans
COMMENTS:	(1) water table at 0.7m
	(2) massive compacted layer (5 cm thick) immediately below plow depth.
	(3) fine shells found throughout profile becoming
	(4)silt and fine sand content appears to increase

CLASSIFICATION

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine clayey over fine silty, alkaline, strongly

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-20 (20-20)	Very dark grayish brown (10YR3/2m), grayish brown (10YR5/2d); silty clay loam; moderate fine subangular blocky breaking to moderate medium granular; slightly sticky, friable, hard, slightly plastic; abrupt smooth boundary; free of coarse fragments.
Bg	20-50	Gray (10YR5.1m), light brownish gray (2.5Y6/2d);silty clay; moderate to strong fine subangular blocky; slightly sticky, friable, hard, slightly plastic; clear wavy boundary; free of coarse fragments except for some animal shells.

SITE 3.7 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckg	50+	Gray (10YR5/1m);light gray (10YR7/2d); silt loam; moderate coarse angular blocky breaking to moderate fine angular blocky; slightly sticky, friable, hard, slightly plastic; moderately effervescent with 10% HCL; some animal shells, otherwise free of coarse fragments.

SERIES 026

SITE DESCRIPTION — DATE OF SAMPLING: Oct.17, 1975

SITE NUMBER:	4.1
LOCATION:	40P/10E322396
SURFACE FORM:	level
SLOPE:	depressional portion of simple 1% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	none
STONINESS:	slightly stony
PRESENT LAND USE:	corn (water transmissibility measurements made in adjacent pasture)
COMMENTS:	the gravelly layer that occurs at depth at this site is not always present in Series 026

CLASSIFICATION:

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine clayey, alkaline, strongly calcareous, mild, subaquic

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	HORIZON
Ap	0-20 (19-22)	Very dark gray (10YR3/1m), grayish brown(10YR5/2d); silty clay loam; moderate fine to medium granular; slightly sticky; friable, slightly hard, plastic; abrupt smooth boundary; very few micro vertical inped roots; common very fine random exped discontinuous dendritic vesicular pores; some gravel, angular gravel, chert and cobbles.
Bg_1	20-55 (18-35)	Brown (10YR5/3m); clay to clay loam, many medium prominent strong brown (7.5YR5/6m) mottles; moderate to strong medium sub-angular blocky; sticky, firm, very hard, very plastic; gradual wavy boundary; common, moderately thick dark grayish brown (10YR4/2m) clay films in many voids/ channels and on some vertical and

SITE 4.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Bg_1 - cont'd		horizontal ped faces; very few micro vertical exped roots; common medium vertical and horizontal exped continuous dendritic tubular pores; few medium oblong very dark grayish brown (10YR3/2m) worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.
Bg_2	55-95	Grayish brown (10YR5/2m); clay; many coarse prominent yellowish brown (10YR5/6m) mottles; moderate medium subangular blocky; sticky, firm, very hard, very plastic; gradual wavy boundary; common, moderately thick very dark grayish brown (10YR4/2m) clay films in all voids/channels and on all vertical and horizontal ped faces; very few micro vertical exped roots; common fine vertical and horizontal exped continuous dendritic tubular pores; few medium oblong very dark grayish brown (10YR3/2m) worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.
Ckg	95-110 (10-30)	Yellowish brown (10YR5/4m); clay loam; many coarse distinct strong brown (7,5YR5/6m) mottles; weak to moderate medium subangular blocky; slightly sticky, firm, hard, plastic; clear wavy boundary; very few micro vertical exped roots; few very fine random exped discontinuous dendritic tubular pores; moderately effervescent; some gravel, angular gravel; chert and cobbles.
II Ckg	110+	Light brownish gray (10YR6/2m), light gray (10YR7/2d); very gravelly coarse sandy loam; many coarse prominent yellowish brown (10Y R5/6m) mottles; structureless single grain; non-sticky, loose, non-plastic; common medium random exped continuous dendritic interstitial pores; moderately effervescent; gravel and

SERIES 025

SITE DESCRIPTION DATE OF SAMPLING: Oct.15, 1975

SITE NUMBER:	4.2
LOCATION:	40P/10E322396
SURFACE FORM:	level
SLOPE:	middle portion of simple 1.5% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	small grains
COMMENTS:	clay content is 5-10% lower than would normally be expected for this series.

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine silty, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-30	Very dark grayish brown (10YR3/2d), gray
	(28-35)	brown (10YR5/2d);silt loam; moderate medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; few very fine oblique inped roots; few very fine random exped discontinuous dendritic vesicular pores; some gravel and cobbles.
Aegj	30-36 (0-20)	Brown (10YR5/3m), pale brown (10Y R6/3d); loam; common coarse distinct brown (7.5YR5/4) mottles; very weak fine to medium granular; slightly sticky, friable, slightly hard, slightly plastic; gradual broken boundary; few very fine oblique inped roots; few pores; common medium oblong very dark grayish brown (10YR3/2m) worm casts throughout matrix; some gravel and cobbles.

SITE 4.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj	36-48 (0-20)	Brown (7.5YR5/4m) ped interiors; clay; few fine faint mottles; strong medium subangular blocky; sticky, firm, hard, plastic; gradual broken boundary; common moderately thick brown to dark brown (10YR4/3m) clay films in many voids and channels and some vertical and horizontal ped faces; very few very fine oblique exped roots; few very fine random exped discontinuous dendritic tubular pores; common medium very dark greyish brown (10YR 3/2m) worm casts throughout matrix; some gravel, chert and cobbles.
Ckgj	48+	Light yellowish brown (10YR6/4m), very pale brown (10YR7/3); silty clay loam; common medium distinct brown (7.5YR5/4) mottles; moderate medium pseudo-subangular blocky; slightly sticky, friable, hard, exped roots; very few micro random exped discontinuous dendritic tubular pores; few medium very dark grayish brown (10YR3/2m) worm casts throughout matrix; strong effervescence with 10% HCL; strongly calcareous; some gravel, chert, cobbles and stones.

SERIES 024

SITE DESCRIPTION	DATE OF SAMPLING: Oct. 16, 1975
SITE NUMBER:	4.3
LOCATION:	40P/10E326368
SURFACE FORM:	undulating
SLOPE:	upper portion of simple 5% slope
DRAINAGE:	moderately well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	mixed forage
CLASSIFICATION	
ORDER:	Luvisol
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, strongly calcareous, mild, humid.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-20 (18-25)	Dark brown (10YR3/3m) grayish brown (10YR 5/2d); silt loam and silty clay loam; moderate medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; plentiful fine random inped roots; common very fine vertical inped discontinuous dendritic tubular pores; few medium very dark gray (10YR3/1m) oblong worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.
Ae	20-25 (0-20)	Dark yellowish brown (10YR4/4m) light gray (10YR5/6d); silty clay loam; few fine faint mottles; weak fine to medium granular; slightly sticky, very friable; slightly plastic; gradual broken boundary; plentiful fine random roots inped and exped; common fine random exped discontinuous tubular pores; common medium very dark gray (10YR3/1m) oblong worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.

SITE 4.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Bt	25-60 (20-42)	Brown (10YR5/3m) inped color, light brownish gray (10YR6/2d); clay; few medium prominent yellowish brown (10YR5/6m) mottles; moderate to strong medium subangular blocky; sticky, firm, very hard, very plastic; clear wavy boundary; many moderately thick brown to dark brown (10YR4/3m) clay skins in all voids/channels and on all vertical and horizontal ped faces; plentiful very fine vertical exped roots; common medium vertical exped continuous dendritic tubular pores; common medium very dark gray (10YR3/1) oblong worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.
Ck	60+	Pale brown (10YR6/3m), very pale brown (10YR7/3d); silty clay loam; few medium prominent strong brown (7.5YR5/6m) mottles; weak very coarse pseudo-platy breaking to weak to moderate medium to coarse sub-angular blocky; sticky, firm, hard, plastic; few medium vertical and horizontal exped roots; common fine vertical and horizontal discontinuous dendritic tubular pores; few medium very dark gray (10YR3/1m) oblong worm casts; strongly effervescent with 10% HCL; some gravel, angular gravel, chert and cobbles.

SERIES 013

SITE DESCRIPTION	DATE OF SAMPLING: Oct. 24, 1975
SITE NUMBER:	4.4
LOCATION:	40P/10E331348
SURFACE FORM:	undulating
SLOPE:	middle portion of simple 2.5% slope
DRAINAGE:	well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	mixed forage
COMMENTS:	site is outside present watershed boundary
CLASSIFICATION	
ORDER:	Luvisol
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Brunisolic Gray Brown Luvisol
FAMILY:	Fine loamy, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-25 (25-30)	Very dark grayish brown (10YR3/2m), dark grayish brown (10YR4/2d); silt loam and loam; moderate medium to coarse granular; slightly sticky, very friable, soft, slightly plastic; abrupt smooth boundary; some gravel, angular gravel, chert, shale and cobbles.
Ae_1	25-30 (0-7)	Dark brown (10YR3/3m), brown (10YR4/3d) silt Loam; moderate coarse granular; slightly sticky, friable, soft, slightly plastic; clear broken boundary; some gravel, angular gravel, chert, shale and cobbles.
Ae_2	30-70 (0-8)	Dark yellowish brown (10YR4/4m), light gray (10YR7/2d); silt loam; moderate medium to coarse granular; slightly sticky, friable, slightly hard, slightly plastic; clear broken boundary; some gravel, angular gravel and cobbles.

SITE 4.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Bt	35-70 (14-50)	Brown to dark brown (10YR4/3m), to yellowish brown (10YR5/4d); clay loam; moderate medium to coarse subangular blocky sticky, friable, hard, plastic; clear, irregular boundary; many moderately thick dark yellowish brown (10YR4/4m) clay films in all voids/channels and on all vertical and horizontal ped faces; some gravel, chert, shale and cobbles.
Ck	70+	Yellowish brown (10YR5/4m), pale brown (10YR6/3d); loam and silt loam; moderate to strong coarse pseudo-platy breaking to moderate medium pseudo-subangular blocky; slightly sticky, friable, hard, slightly plastic; moderately effervescent; some gravel, angular gravel, chert, shale and cobbles.

SERIES 025 - textural variant

SITE DESCRIPTION DATE OF SAMPLING: July 10, 1975

SITE NUMBER:	4.5
LOCATION:	40P/10E344396
SURFACE FORM:	level
SLOPE:	middle portion of simple 1.5% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	mixed forage
COMMENTS:	clay content of C horizon is 5-10% lower than would normally be expected for this series

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine silty, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-20 (19-21)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR6/2d); silt loam; weak medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt smooth boundary; some gravel.
Aegj	20-30 (5-20)	Dark yellowish brown (10YR4/4m); silt loam; common medium faint yellowish brown (10YR 5/5) mottles; weak fine to medium granular; slightly sticky, very friable, slightly hard, slightly plastic; clear wavy boundary; some gravel.
Btgj	30-40 (0-15)	Brown to dark brown (10YR4/3m); silt loam to clay loam; few faint mottles; moderate medium subangular blocky; sticky, firm, very hard, plastic; clear broken boundary; common moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; some gravel, chert and cobbles.

SITE 4.5 - cont'd

HORIZON	NODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckgj	40+	Brown (10YR5/ 3m) , light gray (10YR7/2d) ; clay loam; common medium distinct yellowish brown (10Y R5/5) mottles; moderate medium to coarse subangular blocky; sticky, firm, very hard, plastic; moderately effervescent; some gravel, chert, shale and cobbles.

SERIES 024 DATE OF SAMPLING: July 11, 1975

SITE DESCRIPTION

SITE NUMBER:	4.6
LOCATION:	40P/10E314383
SURFACE FORM:	undulating
SLOPE:	middle portion of simple 4% slope
DRAINAGE:	moderately well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	mixed forage
COMMENTS:	underlain by a loam till at about 2m

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, strong calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-15	Very dark grayish brown (10YR3/2m), grayish brown (10YR5/2d); clay loam; moderate to strong, medium to coarse granular; slightly sticky, friable, hard; abrupt smooth boundary; some gravel and chert.
Ae	15-20 (5-15)	Dark grayish brown (10YR4/2m), light yellowish brown (10YR6/4d); silt loam; weak to moderate fine to medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt wavy boundary; some gravel and chert.
Bt	20-55	Brown to dark brown (10YR4/3m) exped, pale brown (10Y R6/3d) exped; silty clay; strong medium subangular blocky; sticky, firm, very hard, plastic; gradual wavy boundary; continuous moderately thick clay films in all voids/channels and on all vertical and horizontal ped faces; some gravel, chert and cobbles.

SITE 4.6 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ck	55+	Pale brown (10YR6/3m) exped; clay loam to silty clay loam; moderate medium subangular blocky; sticky, firm, very hard, plastic; gravel, chert and cobbles.

SERIES 046

SITE DESCRIPTION DATE OF SAMPLING: Oct.22, 1975

SITE NUMBER	5.1
LOCATION:	40P/2E008817
SURFACE FORM:	level
SLOPE:	depressional simple 1% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	moderately pervious
EROSION:	none
STONINESS:	slightly stony
PRESENT LAND USE:	pasture
COMMENTS:	crotivinas present in B horizon apparent watertable at 1.3 meters

CLASSIFICATION

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine loamy, alkaline, strongly calcareous, mild mesic, subaquic

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-30 (20-30)	Very dark grayish brown (10YR3/2m), grayish brown (10YR5/2d); silt loam; moderate medium granular; slightly sticky, very friable, slightly hard, slightly plastic; clear wavy boundary; abundant very fine vertical and oblique exped roots; many very fine random exped continuous dendritic interstitial pores;
Aejg	30-50 (20-25)	Dark grayish brown (10YR4/2m), light gray (10YR7/2d); loam; common medium prominent dark reddish brown (10YR3/3m) mottles; moderate to strong, medium to coarse granular; sticky, friable, slightly hard, slightly plastic; clear wavy boundary; plentiful very fine vertical exped roots; many very fine vertical exped continuous dendritic tubular pores; common medium oblong dark gray (10YR4/1m) worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.

SITE 5.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
$Btjg_1$	50-70 (20-30)	Grayish brown (10YR5/2m), light gray (10YR7/2d); loam; many coarse prominent reddish brown (5YR4/4m) mottles; moderate medium to coarse subangular blocky; sticky firm, hard, plastic; gradual wavy boundary; many moderately thick clay films in all voids/channels and on all vertical and horizontal ped faces; few very fine vertical exped roots; common very fine vertical exped continuous dendritic tubular pores; many medium oblong dark gray (10YR4/1m) worm casts throughout matrix; some gravel, angular gravel, chert, shale and cobbles.
$Btjg_2$	70-90 (10-40)	Grayish brown (10YR5/2m), light gray (10YR 7/2d); loam; many coarse prominent reddish brown (5YR4/4m) mottles; moderate medium to coarse subangular blocky; sticky, firm, slightly hard, slightly plastic; gradual wavy boundary; common, thin clay films in many voids/channels and on some vertical and horizontal ped faces; few very fine vertical roots; common very fine vertical exped continuous dendritic tubular pores; common, medium oblong dark gray (10YR4/1m) worm casts throughout matrix; some gravel, angular gravel, shale and cobbles.
Ckg	90+	Light brownish gray (10YR6/2m), very pale brown (10YR8/3d); silt loam; many coarse prominent yellowish brown (10YR5/6m) mottles; moderate coarse pseudo-platy; sticky, firm, slightly hard, slightly plastic; very few, very fine vertical and oblique exped roots; common, very fine, vertical and horizontal exped continuous dendritic tubular pores; few medium oblong dark gray (10YR4/1m) worm casts throughout matrix; moderately effervescent with 10% HCL; strongly calcareous; some gravel, angular gravel, chert and cobbles.

SERIES 043 (taxadjunct)

SITE DESCRIPTION DATE OF SAMPLING: Oct.21, 1975

SITE NUMBER:	5.2
LOCATION:	40P/2e032755
SURFACE FORM:	level
SLOPE:	upper portion of simple 2% slope
DRAINAGE:	well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight to moderate water erosion
STONINESS:	slightly stony
PRESENT LAND USE:	corn (harvested)
COMMENTS:	pockets of sand occur in lower B horizon
CLASSIFICATION ORDER:	Brunisolic
GREAT GROUP:	Melanic Brunisol
SUBGROUP:	Degraded Melanic Brunisol
FAMILY:	Coarse loamy, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-22 (20-25)	Very dark grayish brown (10YR3/2m), pale brown (10YR6/3d); silt loam; weak to moderate fine to medium granular, slightly sticky, friable, slightly hard, slightly plastic, abrupt smooth boundary; few very fine oblique roots both inped and exped many very fine random exped continuous dendritic vesicular pores; some gravel, angular gravel and cobbles.
Aej	22-27 (0-10)	Dark yellowish brown (10YR4/6m), very pale brown (10YR7/3d); silt loam; few fine faint mottles; weak medium granular; slightly sticky, friable, slightly hard, slightly plastic; gradual broken boundary; few very fine oblique roots both inped and exped; many very fine and medium random exped continuous dendritic vesicular and tubular pores; common medium very dark grayish brown (10YR3/2m) oblong worm casts throughout matrix; some gravel, angular gravel and cobbles.

SITE 5.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btj	27-55 (25-35)	Dark yellowish brown ped interiors (10YR 4/4m); pale brown (10YR6/3d); loam; weak to moderate medium subangular blocky; sticky, friable, hard, plastic; clear wavy boundary; many moderately thick brown to dark brown (10YR4/3m) clay skins in all voids/channels and on all vertical and horizontal ped faces; few very fine oblique exped roots; many very fine and medium random inped and exped continuous dendritic vesicular, interstitial and tubular pores; common medium very dark grayish brown (10YR3/2) worm casts throughout matrix; some gravel, angular, chert, shale and cobbles.
Ck	55+	Brown (10YR5/3m), very pale brown (10YR7/3d); gritty loam; few fine prominent dark yellowish brown (10YR4/6) mottles; moderate coarse pseudo-platy; slightly sticky; friable, very hard, slightly plastic; very few, very fine oblique roots exped; many very fine medium horizontal exped continuous dendritic vesicular and tubular pores; few medium very dark grayish brown (10YR3/2m) worm casts throughout matrix; moderate effervescence with 10% HCL; strongly calcareous; some gravel, angular gravel, chert, shale and cobbles.

SERIES 045

SITE DESCRIPTION — DATE OF SAMPLING: Oct. 20, 1975

SITE NUMBER:	5.3
LOCATION:	40P/2e027806
SURFACE FORM:	level
SLOPE:	lower portion of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	slightly stony
PRESENT LAND USE:	corn (harvested)

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine loamy, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-25 (17-30)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR6/2d); silt loam; weak to moderate, medium to coarse granular; slightly sticky, friable, soft, slightly plastic; abrupt wavy boundary; plentiful very fine random exped roots; common fine random exped continuous dendritic tubular pores; some gravel, angular gravel, chert and cobbles.
Aegj	25-30 (0-12)	Yellowish brown (10YR5/4m), pale brown (10YR6/3d); silt loam; few fine distinct yellowish brown (10YR5/6m) mottles; weak medium platy break into weak medium granular; slightly sticky, friable, soft, slightly plastic, abrupt broken boundary; plentiful very fine random exped roots; common medium vertical and horizontal exped roots; common medium vertical and horizontal exped continuous dendritic tubular pores; common medium oblong very dark grayish brown (10YR3/2) worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.

SITE 5.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj	30-48 (5-25)	Brown to dark brown (10YR4/3m) inped; loam; few fine prominent yellowish brown (10YR 5/6m) mottles; moderate medium subangular blocky; slightly sticky; friable, slightly hard, plastic; abrupt wavy boundary; common, thin dark yellowish brown (10YR4/4m) clay skins in many voids/channels and on some vertical and horizontal ped faces; plentiful very fine vertical exped roots; common, medium vertical and horizontal exped continuous dendritic tubular pores; common medium oblong very dark grayish brown (10YR3/2m) worm casts throughout matrix; some gravel, angular gravel, chert and cobbles.
Ckgj	48+	Pale brown (10YR6/3m), light gray (10YR7/2d); loam; common fine distinct yellowish brown (10YR5/4m) mottles; weak coarse pseudoplaty; slightly sticky, friable, slightly hard, slightly plastic; few very fine and firm horizontal exped roots; few medium vertical and horizontal exped continuous dendritic tubular pores; few medium oblong very dark grayish brown (10YR3/2m) worm casts throughout matrix; moderately effervescent with 10% HCL; strongly calcareous; some gravel, angular gravel, chert and cobbles.

SERIES 045

DATE OF SAMPLING: Sept. 24, 1975

SITE DESCRIPTION

SITE NUMBER:	5.4
LOCATION:	40P/2e014773
SURFACE FORM:	level
SLOPE:	middle portion of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	slightly stony
PRESENT LAND CLASSIFICATION	corn

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine loamy, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-18 (18-20)	Very dark grayish brown (10YR3/2m); silt loam; moderate fine to medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt smooth boundary; some gravel, chert and cobbles.
$Btgj_1$	18-35 (10-40)	Brown to dark brown (10YR4/3m) exped; silt loam; few medium dark yellowish brown (10YR4/4) mottles; moderate medium subangular blocky; slightly sticky, very friable; slightly hard, slightly plastic; gradual irregular boundary; common moderately thick dark brown (10YR3/3) clay films in many voids/channels and on some vertical and horizontal ped faces; some gravel, chert and cobbles.

SITE 5.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
$Btgj_2$	35-60 (10-50)	Dark yellowish brown (10YR4/4m) exped; few medium distinct dark yellowish brown (10YR5/6) mottles; moderate medium sub-angular blocky; slightly sticky, friable, slightly hard, slightly plastic; clear irregular boundary; many moderately thick dark brown (10Y R3/3m) clay films in many voids/channels and on some vertical and horizontal ped faces; some gravel, angular gravel, chert and cobbles.
Ckgj	60+	Pale brown (10YR6/3m) matrix, brown (10YR4.5/3m) exped; loam to gravelly loam; few fine strong brown (7.5YR5/6) mottles; weak medium to coarse subangular blocky; slightly sticky, friable, slightly hard, slightly plastic; moderately effervescent; gravel, angular gravel and some cobbles.

SERIES 053

SITE DESCRIPTION DATE OF SAMPLING: Sept.22, 1975

SITE NUMBER:	5.5
LOCATION:	40P/2e002796
SURFACE FORM:	undulating
SLOPE:	upper portion of simple. 3% slope
DRAINAGE:	well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	slightly stony
PRESENT LAND USE:	small grains

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Fine loamy, strongly calcareous, mild, humid.

HORIZON	MODAL DEPTH (cm)	DESCRIPTION
Ap	0-25 (25-30)	Very dark grayish brown (10YR3/2m);silt loam; moderate fine to medium granular slightly sticky, friable, slightly plastic; abrupt smooth boundary; some gravel, chert and cobbles.
Ae	25-30 (0-30)	Brown (10YR5/3m); silt loam; weak medium platy; slightly sticky, friable slightly plastic, gradual broken boundary; some gravel, chert and cobbles.
Bt	30-60	Dark yellowish brown (10YR3/4m); loam and sandy clay loam; moderate to strong medium subangular blocky, sticky, firm, plastic, gradual, irregular boundary; common thin clay films in many voids and on some vertical and horizontal ped faces; some gravel, chert, cobbles and stones.

SITE 5.5 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ck	60-65 (0- 8)	Brown (10YR5/3m); loam; very weak fine granular; slightly sticky, friable, slightly plastic, gradual broken boundary; moderately effervescent; some gravel, chert, cobbles and stones.
II Ck	65+	Brown (10YR5/3m) and yellowish brown (10YR5/6m); gravelly fine sandy loam; single grain; non-sticky, loose, non-plastic, moderately effervescent; gravel, some angular gravel and cobbles.

SERIES 043

SITE DESCRIPTION DATE OF SAMPLING: Sept. 23, 1975

SITE NUMBER:	5.6
LOCATION:	40P/2e000806
SURFACE FORM:	undulating
SLOPE:	upper portion of simple 4% slope
DRAINAGE:	well drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	slightly stony
PRESENT LAND USE:	corn
COMMENTS:	underlain at 1.2m medium sand which accounts, in part, for the deep solum.

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Orthic Gray Brown Luvisol
FAMILY:	Coarse loamy, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-28	Very dark grayish brown (10YR3/2m); silt loam; moderate medium granular; slightly sticky, very friable, soft, slightly plastic; abrupt wavy boundary; some gravel, chert and cobbles.
Ae	28-50 (12-36)	Brown to dark brown (10YR4/3m); silt loam; weak to moderate fine to medium granular; slightly sticky, very friable, soft, slightly plastic; clear wavy boundary; some gravel, chert and cobbles.
Bt	50-100 (30-60)	Yellowish brown (10YR5/6m) with very pale brown (10YR7/3m) streaks; loam; moderate to strong medium subangular blocky; sticky, friable, hard, plastic; gradual wavy boundary; many moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; some gravel,

SITE 5.6 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ck	100-200 (0-40)	Light yellowish brown (10YR6/4m); loam; moderate medium sub angular blocky; slightly sticky, friable, slightly hard, slightly plastic; moderately effervescent; some gravel, angular gravel, chert and cobbles.
II Ck	120+	Light yellowish brown (10YR6/4m); sand; single grain (structureless); nonsticky, loose, nonplastic; moderately effervescent; some gravel.

SERIES 266

SITE DESCRIPTION DATE OF SAMPLING: July 26, 1976

SITE NUMBER:	10.1
LOCATION:	30m/4a121711
SURFACE FORM:	level
SLOPE:	complex depressional 1% slope
DRAINAGE:	poorly drained
PERVIOUSNESS:	slowly pervious
EROSION:	nil
STONINESS:	nonstony
PRESENT LAND USE:	abandoned farmland
COMMENTS:	a discontinuous zone directly underlying the Ap is very highly mottled

CLASSIFICATION:

ORDER:	Gleysolic
GREAT GROUP:	Humic Gleysol
SUBGROUP:	Orthic Humic Gleysol
FAMILY:	Fine clayey, alkaline, strongly calcareous, mild, subaquic.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANCE)	DESCRIPTION
Ap	0-15 (10-20)	Dark brown (10YR3/3m), light gray (10YR 7/2d); silty clay loam; strong medium angular blocky breaking to strong medium granular; sticky, firm, hard, slightly plastic; abrupt smooth boundary; plentiful fine random inped and exped roots; many medium vertical exped continuous dendritic interstitial pores; some angular gravel and red shale.
Bg	15-40 (25-30)	Dark gray (10YR4/1m), light brownish gray (10YR6/2d), silty clay and clay; common medium prominent dark yellowish brown (10YR4/4) mottles; strong coarse prismatic breaking to strong medium angular blocky; sticky, firm, very hard, plastic; clear smooth boundary; few fine vertical inped and exped roots; many medium vertical exped continuous dendritic interstitial pores; some angular gravel and red shale.

SITE 10.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckg	40+	Gray (10YR5/1m), light gray (10YR7/1.5d); clay to heavy clay; few medium prominent dark yellowish brown (10YR4/4) mottles; moderate coarse prismatic breaking to strong medium angular blocky; sticky, very firm, very hard, plastic; very few fine vertical inped and exped roots; common medium vertical exped continuous dendritic interstitial pores; moderately effervescent; some angular gravel and red shale.

SERIES 265

SITE DESCRIPTION DATE OF SAMPLING: July 26, 1976

SITE NUMBER:	10.2
LOCATION:	30M/4b108722
SURFACE FORM:	level with low hummocks
SLOPE:	upper portion of complex 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	mixed forage
COMMENTS:	iron and manganese concretions are common in the Ap and Aegj horizons

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANCE)	DESCRIPTION
Ap	0-17 (14-17)	Very dark grayish brown (10YR3/2m), brown (10YR5/3d); clay loam; strong fine sub-angular blocky breaking to strong fine to medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; abundant very fine random inped and exped roots; many very fine random exped continuous dendritic interstitial pores; some angular gravel and shale.
Aegj	17-22 (0-5)	Brown (10YR5/3m), light gray (10YR7/2d); clay loam; common medium prominent yellowish brown (10YR5/6) mottles; weak to moderate medium granular; slightly sticky, friable, hard, slightly plastic; abrupt broken boundary; plentiful very fine random inped and exped roots; many very fine random exped continuous dendritic

SITE 10.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
$Btgj_1$	22-30 (0-10)	Dark gray (10YR4/1.5m); light gray (10YR 7/3d); silty clay; common medium prominent yellowish brown (10YR5/6) mottles; strong coarse prismatic breaking to strong medium angular blocky; sticky firm, very hard, plastic; gradual broken boundary; common thin clay films in many voids/channels and on some vertical and horizontal ped faces; plentiful very fine vertical exped roots; many medium vertical exped continuous dendritic interstitial pores; some angular gravel and shale.
$Btgj_2$	30-53 (16-32)	Dark gray (10YR4/1.5m), light gray (10YR 7/3d); clay; few medium prominent yellowish brown (10YR5/6) mottles; strong coarse prismatic breaking to strong medium angular blocky; sticky, firm, very hard, very plastic; clear wavy boundary; common thin clay films in many voids/channels and on some vertical and horizontal ped faces; few very fine vertical exped roots; many medium vertical exped continuous dendritic interstitial pores; some red shale and angular gravel.
Ckgj	53+	Dark gray (10YR4/1m), light gray (10YR 7/2d); silty clay; few medium prominent yellowish brown (10YR5/6) mottles; strong coarse prismatic breaking to strong medium to coarse angular blocky; sticky, firm, very hard, very plastic; very few, very fine vertical exped roots; common medium vertical exped continuous dendritic interstitial pores; moderately effervescent; some angular

SERIES 265

SITE DESCRIPTION — DATE OF SAMPLING: Sept. 8, 1976

SITE NUMBER:	10.3
LOCATION:	30M/4a150707
SURFACE FORM:	level
SLOPE:	upper portion of complex 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	nonstony
PRESENT LAND USE:	fall plowed after small grains

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Very fine clayey, strong calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-15 (15-18)	Very dark grayish brown (10YR3/2m), light brownish gray (10YR6/2d) ;silty clay; moderate fine angular blocky breaking to moderate to strong medium granular; slightly sticky; friable, hard, plastic, abrupt smooth boundary; some angular gravel.
Aegj	15-20 (0- 7)	Dark grayish brown (10YR4/2.5m), light gray (10YR7/2d); silty clay; many medium prominent yellowish brown (10YR5/8) mottles; moderate medium angular blocky breaking to moderate medium granular; sticky, firm, hard, plastic; clear broek boundary; free of coarse fragments.
Btgj	20-45 (20-30)	Dark grayish brown (10YR4/2m), pale brown (10YR6/3d); heavy clay; few fine distinct dark yellowish brown (10Y R4/4) mottles; strong coarse prismatic breaking to moderate to strong coarse angular blocky; sticky, firm, very hard, plastic; clear wavy boundary; many moderate thick clay films in many voids/channels and on some vertical and horizontal ped faces; some angular gravel and shale.

SITE 10.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckgj	45+	Very dark grayish brown (10YR3.5/2m), light grayish (10YR7/2d); heavy clay and silty clay; few fine distinct dark yellowish brown (10YR4/4) mottles; moderate medium to coarse angular blocky breaking to strong fine angular blocky; very sticky, firm, very hard, very plastic; moderately effervescent; some angular gravel and red shale.

SERIES 264

SITE DESCRIPTION DATE OF SAMPLING: Sept. 8, 1976

SITE NUMBER: 10.4

LOCATION: 30M/4a187704

SURFACE FORM: undulating

SLOPE: upper portion of simple 4% slope

DRAINAGE: moderately well drained

PERVIOUSNESS: moderately pervious

EROSION: moderate water erosion

STONINESS: nonstony

PRESENT LAND USE: mixed forage, mainly alfalfa

COMMENTS: a very thin (<2 cm) zone of intense mottling immediately below the Ap horizon was present. The zone was discontinuous and probably represents the remnants of an Aegj horizon.

CLASSIFICATION

ORDER: Luvisolic

GREAT GROUP: Gray Brown Luvisol

SUBGROUP: Orthic Gray Brown Luvisol

FAMILY: very fine clayey, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-15 (15-17)	Brown to dark brown (10YR4/3m), brown (10YR6/3d); silty clay; strong medium angular blocky breaking to strong medium granular; slightly sticky, firm, hard, plastic; abrupt smooth boundary; some angular gravel.
Bt	15-40 (20-30)	Brown to dark brown (10YP4/3m), pale brown (10YR6/3d); heavy clay; strong coarse prismatic breaking to strong medium angular blocky; sticky, very firm, very hard, very plastic, abrupt wavy boundary; many moderately thick clay films in many voids/channels and on some vertical and horizontal ped faces; some angular gravel.

SITE 10.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Bt_2	40-42 (0- 5)	Dark grayish brown (10YR4/2m); light gray (10Y R7/2d); heavy clay; few fine distinct dark yellowish brown (10YR4/4) mottles; strong coarse prismatic breaking to strong medium angular blocky; very sticky, very firm, extremely hard, very plastic; clear broken boundary; many moderately thick clay films in many voided channels and on some vertical and horizontal ped faces; some angular gravel and red shale.
Ck	42+	Dark grayish brown (10Y R4/2); light gray (10YR7/2d); heavy clay; few, fine, distinct dark yellowish brown (10YR4/4) mottles; strong coarse angular blocky breaking to strong fine angular blocky; very sticky, very firm, extremely hard, very plastic; moderately effervescent; some angular gravel and red shale.

SERIES 255

SITE DESCRIPTION — DATE OF SAMPLING: Sept. 9, 1976

SITE NUMBER:	10.5
LOCATION:	30M/4b118732
SURFACE FORM:	level
SLOPE:	mid portion of simple 3% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight water erosion
STONINESS:	nonstony
PRESENT LAND USE:	mixed forage

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Fine clayey, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm)	DESCRIPTION
Ap	0-15 (15-15)	Brown to dark brown (10YR4/3m), pale brown (10YR6/3d); silty clay loam, strong medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; free of coarse fragments.
Aegj	15-25 (8-12)	Dark brown (10YR3/3m); brown (10YR5/3d) silty clay loam; few fine prominent yellowish brown (10YR5/6) mottles; strong medium granular; slightly sticky, friable, firm, hard, slightly plastic; clear smooth boundary; free of coarse fragments.
Btgj	25-50 (20-20)	Brown to dark brown (10YR4/3m), brown (10YR5/3d); silty clay; few fine distinct dark yellowish brown (10YR4/4) mottles; strong coarse prismatic breaking to strong medium to coarse angular blocky; sticky, firm, very hard, very plastic; clear smooth boundary; many moderately thick clay films in all voids/channels and on all vertical and horizontal ped faces; free of coarse fragments.

SITE 10.5 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ckgj	50-62 (0-15)	Very dark grayish brown (10YR3/2m) , yellowish brown (10YR5/4d); silty clay and silty clay loam; few fine distinct dark yellowish brown (10YR4/4) mottles; strong coarse prismatic breaking to strong medium to coarse angular blocky; sticky, firm, very hard, very plastic; abrupt broken boundary; moderately effervescent; free of coarse fragments.
II Ckgj	62+	Olive brown (2.5Y4/4m), light yellowish brown (2.5Y6/4d); silt loam and silty clay loam; common medium distinct olive yellow (2.5Y6/6) mottles; weak coarse pseudo-platy breaking to weak fine granular; slightly sticky, very friable, soft, slightly plastic; moderately effervescent; free of coarse fragments.

SERIES 265

SITE DESCRIPTION — DATE OF SAMPLING: Sept. 9, 1976

SITE NUMBER: 10.6

LOCATION: 30m/4b097717

SURFACE FORM: level

SLOPE: upper portion of complex 1% slope

DRAINAGE: imperfectly

PERVIOUSNESS: moderately pervious

EROSION: slight water erosion

STONINESS: nonstony

PRESENT LAND USE: mixed forage for pasture

CLASSIFICATION

ORDER: Luvisolic

GREAT GROUP: Gray Brown Luvisol

SUBGROUP: Gleyed Orthic Gray Brown Luvisol

FAMILY: Very fine clayey, strongly calcareous, mild, humid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-15 (15-15)	Dark brown to brown (10YR4/3m); light brownish gray (10YR6/2d); silty clay loam; moderate medium angular blocky breaking to moderate to strong medium granular; slightly sticky, friable, slightly hard, slightly plastic; abrupt smooth boundary; some gravel.
Aegj	15-25 (8-12)	Pale brown (10YR6/3m), light gray (10YR7/2d); silty clay; common medium distinct yellowish brown (10YR5/5) mottles; weak to moderate medium angular blocky breaking to weak to moderate medium granular; slightly sticky, friable, slightly hard, slightly plastic; clear smooth boundary, some gravel.
Btgj	25-55 (25-35)	Dark grayish brown (10YR4/3m, pale brown (10YR6/3d); heavy clay; few fine prominent yellowish brown (10YR5/6) mottles; strong coarse prismatic breaking to strong medium to coarse angular blocky; sticky, firm, very hard, plastic; gradual smooth boundary;

SITE 10.6 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Btgj -	cont'd	common moderately thick clay films in all voids/channels and on all vertical and horizontal ped faces; some gravel and shale.
Ckgj	55+	Dark grayish brown (10YR3.5/2m), light brownish gray (10YR6/2d), heavy clay; few medium distinct dark yellowish brown (10YR4/4) mottles; strong coarse prismatic breaking to strong medium to coarse angular blocky; sticky, firm, very hard, plastic; moderately effervescent; some gravel and shale.

SERIES 115s

SITE DESCRIPTION DATE OF SAMPLING: Oct. 27, 1975

SITE NUMBER: 13.1

LOCATION: 40J/2a705585

SURFACE FORM: level

SLOPE: upper portion of simple 1% slope

DRAINAGE: imperfectly drained

PERVIOUSNESS: moderately pervious

EROSION: slight

STONINESS: non stony

PRESENT LAND USE: soyabeans (harvested)

COMMENTS: Aegj horizon exhibits secondary Brunisolic development in some sectors of exposure.

CLASSIFICATION

ORDER: Luvisolic

GREAT GROUP: Gray Brown Luvisol

SUBGROUP: Gleyed Orthic Gray Brown Luvisol

FAMILY: Coarse loamy, strongly calcareous, mild, subhumid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-30 (30-34)	Dark grayish brown (10YR4/2m), light brownish gray (10YR6/2.5d); loamy fine sand; weak coarse granular; slightly sticky, very friable, soft, nonplastic; abrupt smooth boundary; free of coarse fragments.
Aegj	30-45 (10-25)	Yellowish brown (10YR5/4m), very pale brown (10Y R7/3d); loamy fine sand; common medium distinct dark yellowish brown (10YR4/6) mottles; weak fine to medium granular; nonsticky, very friable, soft, nonplastic; clear wavy boundary; free of coarse fragments.
II Btgj	45-65 (15-34)	Brown (10YR5/3m), very pale brown (10YR7/3d); fine sandy loam; common medium distinct yellowish brown (10YR5/5) mottles; weak to moderate medium subangular blocky; sticky, friable, slightly hard, slightly plastic; gradual irregular boundary; many moderately thick brown (10YR5/3m) clay skins in many voids/channels and on

SITE 13.1 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
II Btgj -	cont'd	some vertical and horizontal ped faces; few medium oblong very dark gray (10YR3/1m) worm casts throughout matrix; free of coarse fragments.
II Ckgj	65+	Yellowish brown (10YR5/4m), very pale brown (10YR8/4d); very fine sandy loam; common coarse distinct yellowish brown (10YR5/5) mottles; weak to moderate coarse pseudoplaty; slightly sticky, very friable, soft, nonplastic; moderately effervescent; free of coarse fragments.

SERIES 105

SITE DESCRIPTION

DATE OF SAMPLING: Oct. 27, 1975

SITE NUMBER:	13.2
LOCATION:	40J/2a686591
SURFACE FORM:	level
SLOPE:	crest of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	rapidly pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	rye cover crop after tobacco

CLASSIFICATION

ORDER:	Brunisolic
GREAT GROUP:	Melanic Brunisol
SUBGROUP:	Gleyed Orthic Melanic Brunisol
FAMILY:	Sandy, strongly calcareous, mild, subhumid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-25 (25-30)	Dark grayish brown (10YR4/2m), brown (10YR5/3d); loamy fine sand; very weak medium to coarse granular; non-sticky, very friable, soft, nonplastic; abrupt smooth boundary; free of coarse fragments.
Bra	25-55 (10-30)	Yellowish brown (10YR5/8m), brownish yellow (10YR6/8d); fine sand; few fine distinct strongly brown (7.5YR5/8) mottles; very weak medium to coarse subangular blocky; nonsticky, very friable, soft, nonplastic; diffuse wavy boundary; few medium oblong grayish brown (10YR5/3m) worm casts; free of coarse fragments.
Bg	55-95 (35-55)	Yellowish brown (10YR5/6m), brownish yellow (10YR6/6d); fine sand; many coarse prominent yellowish red (5YR5/8m) mottles; very weak medium to coarse granular; nonsticky, very friable, soft, nonplastic; diffuse wavy boundary; few medium oblong grayish brown (10YR5/3m) worm casts; free of coarse fragments.

SITE 13.2 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
BCg	95-110 (10-20)	Yellowish brown (10YR5/4m), brownish yellow (10YR6/6d); fine sand; few coarse prominent strong brown (7.5YR5/8m) mottles; very weak medium to coarse granular; nonsticky, very friable, soft, nonplastic; diffuse wavy boundary; free of coarse fragments.
Ckg	110+	Light olive brown (2.5YR5/4m), pale yellow (2.5YR7/4d); very fine sandy loam; many coarse prominent yellowish brown (10YR5/8m) mottles; very weak coarse bedded pseudo-platy; slightly sticky, very friable, soft, nonplastic; moderately effervescent; free of coarse fragments.

SERIES 115s - taxadjunct

SITE DESCRIPTION DATE OF SAMPLING: Oct. 28, 1976

SITE NUMBER:	13.3
LOCATION:	40J/2a724576
SURFACE FORM:	level
SLOPE:	middle portion of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	boundary between tomatoes and soyabeans
COMMENTS:	underlain by silty clay loam to silty clay till at 1.2-2 m.

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Brunisolic Gray Brown Luvisol
FAMILY:	Coarse loamy, strongly calcareous, mild, subhumid

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-21	Dark grayish brown (10Y R4/2m), grayish brown (10YR5/2d); fine sandy loam; very weak coarse angular blocky breaking to very weak medium to coarse granular; slightly sticky; very friable,soft, nonplastic; abrupt smooth boundary, free of coarse fragments.
$Aegj_1$	21-32 (0-11)	Yellowish brown (10YR4.6/5m), brownish yellow (10YR6/6d); loamy fine sand; common medium distinct dark yellowish brown (10YR4/6) mottles; very weak medium to coarse granular; slightly sticky, very friable, soft, nonplastic; gradual broken boundary; free of coarse fragments.

SITE 13.3 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
$Aegj_2$	32-53 (21-47)	Light olive brown (2.5YR5/4m) , light yellowish brown (2.5YR6/4d); loamy fine sand; common medium distinct dark yellowish brown (10YR4/5); very weak, very coarse angular blocky breaking to very weak medium to coarse granular; slightly sticky, very friable, soft, nonplastic; clear wavy boundary; free of coarse fragments.
II Btgj	53-63 (0-15)	Dark yellowish brown (10Y R4/4m), brownish yellow (10YR6/6d); very fine sandy loam; many medium distinct yellowish brown (10YR5/6) mottles; moderate medium to coarse subangular blocky; sticky, friable, slightly hard, plastic; gradual broken boundary; common moderately thick clay skins in many voids/channels and on some vertical and horizontal ped faces; small amounts of gravel.
II Btg	63-86 (16-25)	Brown (10YR5/3.5m), light yellowish brown (10YR6/4d); loam; many medium prominent strong brown (7.5YR5/8m) mottles; weak to moderate medium to coarse subangular blocky; sticky, friable, slightly hard, plastic; diffuse wavy boundary; few moderately thick clay skins in many voids/channels and on some amounts of well rounded gravel.
II Ckg	86+	Light brownish gray (10YR6/2m), light gray (10YR7/2d); loam; many medium prominent strong brown (7.5YR5/8m) mottles; weak very coarse laminated pseudo-platy breaking to weak medium to coarse subangular blocky; sticky, friable, slightly hard, slightly plastic; moderately effervescent; some gravel.

SERIES 095

SITE DESCRIPTION — DATE OF SAMPLING: Nov. 28, 1975

SITE NUMBER:	13.4
LOCATION:	40J/2a657600
SURFACE FORM:	level
SLOPE:	lower portion of simple 1% slope
DRAINAGE:	imperfectly drained
PERVIOUSNESS:	moderately pervious
EROSION:	slight
STONINESS:	nonstony
PRESENT LAND USE:	cover crop of rye following tobacco

CLASSIFICATION

ORDER:	Luvisolic
GREAT GROUP:	Gray Brown Luvisol
SUBGROUP:	Gleyed Orthic Gray Brown Luvisol
FAMILY:	Coarse loamy, strongly calcareous, mild, subhumid.

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
Ap	0-31 (20-35)	Very dark grayish brown (10YR3/2m); loamy sand; very weak coarse subangular blocky; nonsticky, loose, nonplastic; abrupt wavy boundary;some gravel.
Aegj	31-61 (20-35)	Yellowish brown (10YR5/4m); loamy sand; common medium distinct strong brown (7.5YR4/6) mottles; very weak medium subangular blocky; nonsticky, loose, nonplastic; clear wavy boundary; some gravel.
Btgj	61-86 (23-36)	Dark brown to brown (7.5YR4/4m); sandy loam; common medium distinct strong brown (7.5YR4/6) mottles; weak coarse subangular blocky; slightly sticky, very friable, slightly plastic; few thin clay films in voids and channels with visible bridges between sand grains; some gravel.

SITE 13.4 - cont'd

HORIZON	MODAL DEPTH (cm) (THICKNESS RANGE)	DESCRIPTION
BCgj	86-116 (21-36)	Brown (10YR5/3m); sand; few coarse distinct yellowish brown (10YR5/4) mottles; single grain (structureless); nonsticky, loose, nonplastic; gradual wavy boundary; some gravel.
Ckg	116	Grayish brown (10YR5/2m) ; sand; few coarse prominent strong brown (7.5YR4/6) mottles; single grain; nonsticky, loose, nonplastic; moderately effervescent; some gravel.

APPENDIX II

ROUTINE ANALYTICAL DATA FOR MAJOR SOIL SERIES

Appendix II contains the routine analytical data for the sites described in Appendix I. The site numbering system is the same for both appendices . . the integer portion of the site number keys to a subwatershed and the decimal portion gives the location within the subwatershed.

In most cases, more than one sample for routine analysis was collected for each horizon. The standard deviation is presented directly below the mean for each determination. Cation exchange capacity (C.E.C.) determinations were performed on one composite sample per horizon so standard deviations are not presented for this parameter.

ANALYTICAL DATA SITE 1.1 SERIES 176

	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)										$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002	Texture	
Ap	0-16	6	0.6	1	1	6	10	6	25	38	37		0.1
				0	I	1	1	1	2	1	2	CL	0.1
Bg_1	16-45	1	0.8	0	1	5	9	6	21	34	45	C	0.2
				-	-	-	-	-	-	-	-		-
Bg_2	45-116	6	0.6	1	2	5	9	5	21	34	45	C	0.0
				0	1	1	1	1	1	1	2		0.1
Ckg	116+	6	1.1	1	1	4	10	6	21	39	40	CL-	7.2
				0	1	1	1	I	2	2	2	C	4.9

HORIZON	NA-PYROPHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mn	K		H_2O	$CaCl_2$		
	.17	.09	--	.66	.18	.01	10.8	1.7	0.7	27	5.7	5.4	2.5	30.0
Ap	.01	.01	--	.03	.02	0	0.3	0.0	0.0	6	0.1	0.2	0.2	--
Bg_1	.09	.08	--	.33	.21	.02	10.5	2.7	0.5	4	6.7	6.4	1.0	28.0
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bg_2	.04	.01	--	.26	.13	.05	11.8	1.7	0.5	2	7.3	7.0	0.4	29.2
	.01	.01	--	.06	.01	.02	1.0	0.0	0.0	0	0.2	0.2	0.1	--
Ckg	.04	.01	--	.17	.09	.04	19.1	--	0.3	3	7.9	7.5	0.6	
	03	.01-	--	.04	.01	.01	0.4	--	0.0	2	0.1	0.1	0.1	

ANALYTICAL DATA SITE 1.2 SERIES 176 variant

HORIZON	VOCAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0 -30	6	--	1	2	7	20	8	36	35	29	CL	0.1
			--	1	1	1	1	1	2	1	1		0.1
Bg	30- 60	6	--	1	1	5	14	8	28	34	38	CL	0.1
			--	1	0	2	3	1	6	3	5		0.1
Ckg	60+	6	--	1	1	3	6	4	15	46	40	SICL-SIC	12.7
			--	1	1	1	1	1	2	3	2		3.2

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.15	.06	--	.36	.14	.02	10.3	0.3	0.6	21	7.1	6.9	4.0	31.7
	.01	.01	--	.04	.01	.01	0.4	0.7	0.1	4	0.0	0.1	0.2	--
Bg	.16	.04	--	.31	.12	.03	9.3	1.7	0.5	3	7.4	7.1	0.8	28.4
	.03	.01	--	.05	.01	.02	0.9	0.0	0.1	I	0.1	0.1	0.1	--
Ckg	.02	.00	--	.25	.07	.03	34.4	1.7	0.4	I	7.9	7.6	0.6	
	.01	.01	--	.04	.01	.01	1.3	0.0	0.1	0	0.0	0.0	0.1	

HORIZON	MODAL DEPTH (cm)	NO. of cr REPLICATES	PARTICLE SIZE DISTRIBUTION(%,size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1.2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-28	2	2	1	6	34	39	3	82	12	7	LS	0.5
			1	I	1	1	3	0	0	0	1		0.7
Aegi	28-36	2	2	2	6	41	41	3	91	8	2	S	0.0
			1	1	5	1	6	1	2	14	1		0.0
Btgi	36-60	2	3	1	4	24	49	2	79	8	14	FSL	0.0
			1	0	2	3	14	0	8	5	4		0.0
IICkg	60+	2	6	2	2	3	6	4	16	43	43	SIC	19.9
			2	1	1	0	1	0	1	1	1		0.4

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/ 100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.12	.18	0	.18	.32	0	4.3	0.6	0.3	12	5.9	5.4	2.5	
	.01	.01	0	0	.01	0	1.0	0.0	0.0	1	0.2	0.1	0.1	
Aegi	.03	.02	0	.07	.04	.02	1.5	0.3	0.1	1	6.3	5.6	0.2	
	.01	.01	0	.04	.01	.02	0.0	0.0	0.0	0	0.1	0.1	0.1	
Btgi	.02	.01	0	.05	.05	.01	7.0	2.I	0.1	1	7.3	7.0	0.2	
	.01	0	0	0	0	0	0.0	0.6	0.0	0	0.0	0.0	0.1	
IICkg	0	0	0	.10	.06	.02	25.5	4.3	0.3	1	7.9	7.6	0.7	
	.01	0	0	0	.01	.01	0.0	0.1	0.0	0	0.1	0.1	0.1	

ANALYTICAL DATA SITE 1.4 SERIES 176S

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-22	2	2	1	3	18	45	4	70	18	13	FSL	0.2
			0	0	1	1	2	0	1	0	0		0.0
Bg	22-47	2	5	2	2	14	45	4	65	20	16	FSL	0.1
			1	1	2	3	15	1	16	11	6		0.1
IIBg	47- 95	2	4	1	2	3	11	5	21	40	40	CL-	6.7
			1	0	1	0	0	1	1	0	1	C	4.7
IICkg	95+	2	3	1	2	3	10	7	22	45	34	CL-	14.8
			1	0	1	1	4	1	7	4	4	SICL	1.5

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.12	.14	0	.17	.19	0	7.5	1.9	0.2	8	6.6	6.0	2.9	
	.01	.01	0	.02	.02	0	0.0	0.I	0.0	0	0.1	0.2	0.4	
B g	.09	.08	0	.13	.07	0	8.0	2.1	0.1	1	6.8	6.4	0.5	
	.03	.06	0	.01	.01	.01	0.0	0.6	0.0	0	0.0	0.0	0.4	
IIBg	.03	.01	0	.19	.09	.04	26.3	4.9	0.3	1	7.7	7.5	1.4	
	.02	0	0	.05	.01	.01	1.1	0.3	0.1	0	0.0	0.1	0.2	
IICkg	0	.02	0	.12	.05	.01	24.0	4.3	0.3	1	7.9	7.6	1.5	
	.01	.01	0	.01	0	0	0.0	0.2	0.0	0	0.1	0.0	0.6	

ANALYTICAL DATA SITE 1.5 SERIES 175g

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-20	2	15	2	6	22	25	3	56	28	17	SL	0.2
			4	0	1	1	1	1	2	1	1		0.1
Aegj	20-28	2	25	6	11	22	21	3	61	25	14	GSL	0.3
			2	3	4	2	6	3	0	1	1		0.1
Btgj	28-54	1	25	10	16	21	9	3	57	17	26	GSCL	0.3
			--	--	--	--	--	--	--	--	--		
IIBtgj	28-54	1	2	1	1	3	6	8	19	41	41	SI	0.7
			--	--	--	--	--	--	--	--	--		
IICkg	54+	2	4	1	2	3	8	4	17	46	38	SICL	16.6
			2	0	1	1	1	0	3	2	0		1.1

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	M	K		H_2O	$CaCl_2$		
Ap	.17	.07	0	.27	.12	.01	11.0	3.2	0.3	13	7.0	6.6	4.0	
	.02	.01	.01	.01	.01	0	0.7	0	0	2	0.1	0.1	0.1	
Aegj	.14	.06	0	.16	.09	0	5.5	2.1	0.2	4	7.0	6.4	0.7	
	.01	.01	0	.03	.01	.01	0	0	0.1	1	0.1	0.1	0.2	
Btgj	.13	.07	0	.14	.11	.09	11.0	5.3	0.3	1	7.2	6.9	0.6	
	--	--	--	--	--	--	--	--	--	--	--	--	--	
IIBtgj	.06	.03	0	.13	.14	.03	14.3	5.3	0.3	1	7.5	7.1	0.6	
	--	--	--	--	--	--	--	--	--	--	--	--	--	
IICkg	0	.01	0	.14	.07	.03	25.0	5.3	0.2	1	7.9	7.6	0.5	
	0	.01	0	0	.01	.01	0	0	0	0	0.0	0.1	0.1	

ANALYTICAL DATA SITE 1.6 SERIES176

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%,size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-25	2	1	1	2	10	16	4	34	33	35	CL	0
			0	0	0	1	1	1	1	1	1		0
Bg_1	25-75	2	2	2	4	14	16	5	40	18	43	C	0.1
			1	0	0	0	3	I	1	12	13		0.1
Bg_2	75-100	2	2	1	2	7	11	4	24	35	42	C	0
			1	1	0	2	2	0	6	4	2		0
Ckg	100+	2	4	2	1	4	6	4	16	43	41	SIC	21.7
			1	1	1	1	1	1	3	1	4		0.7

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.17	.09	--	.29	.18	.02	13.0	3.9	0.5	32	6.9	6.5	3.4	
	.02	0	--	.05	.01	.02	0	0.1	0	2	0.1	0.0	0.2	
Bg_1	.09	.03	--	.16	.13	.05	17.0	5.3	0.3	2	7.6	7.1	0.5	
	.03	.01	--	.01	.01	.02	2.1	0.1	0.1	1	0.1	0.1	0.1	
Bg_2	.04	.02	--	.15	.12	.11	17.3	5.3	0.2	1	7.7	7.4	0.6	
	.01	.01	--	.07	.01	.04	1.1	0.0	0.0	0	0.0	0.0	0.1	
Ckg	0	0	--	.12	.06	.01	28.0	5.2	0.2	4	8.0	7.7	1.0	
	.01	0	--	.01	.01	0	0	0.2	0.1	3	0.1	0.0	0.1	

ANALYTICAL DATA SITE 1.7 SERIES 175

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-20	2	2	2	2	10	16	11	38	40	22	L	0
			0	1	0	1	1	0	1	0	1		
Aegj	20-22	1	1	1	3	11	15	7	37	38	25	L	0
			-	-	-	--	--	-	--	--	--		
Btgj	22-50	2	2	I	2	3	7	3	14	38	49	C	0.1
			1	1	1	1	1	0	2	4	2		0.1
Ckgj	50+	2	2	1	2	3	7	5	17	46	38	SICL	13.1
			0	6	0	0	1	1	2	1	1		2.2

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.19	.06	0	.22	.15	0	10.5	2.9	0.2	12	6.8	6.3	2.7	
	.01	.01	0	.01	.01	0	0.7	0.2	0	1	0.4	0.4	0.1	
Aegj	.18	.06	0	.11	.13	.01	10.0	4.1	0.1	2	6.8	6.4	0.8	
Btgj	.16	.05	0	.17	.17	.04	15.8	5.3	0.2	1	7.5	7.1	0.8	
	.03	.01	0	.05	.03	0	1.1	0	0	0	0.1	0.1	0.0	
Ckgj	.02	.01	0	.16	.09	.02	27.0	5.3	0.2	2	8.0	7.7	0.6	
	.01	.00	0	.03	.01	.00	1.4	0.0	0.0	0	0.0	0.0	0.1	

ANALYTICAL DATA SITE 3.1 SERIES 226

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES.	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-30	1	0	-	-	-	-	-	6	56	33	SICL	0
Bg_1	30-45	1	0	-	-	-	-	-	4	58	38	SICL	0
Bg_2	45-70	1	0	-	-	-	-	-	6	51	43	SIC	0.1
IICkg	70+	I	9	-	-	-	-	-	2	59	39	SICL	54.0

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.02	.12	0	.26	.30	.01	26.0	4.7	0.3	10	7.5	7.3	3.2	
Bg_1	.11	.04	0	.17	.21	.01	20.0	4.8	0.2	1	7.9	7.5	0.4	
Bg_2	.11	.04	0	.22	.19	.03	18.5	4.5	0.2	1	7.7	7.5	0.4	
IICkg	0	.01	0	.11	.05	0	23.0	2.5	0.2	1	3.0	7.6	0.3	

ANALYTICAL DATA SITE 3.2 SERIES 235

HORIZON	MODAL DEPTH (cm)	NO of REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in mm)									Texture	$CaCO_3$ (%)
			Gravel >2	VCS 1-2	CS' .5-1	MS .25-.5	FS .1-.25	VFS .05-1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-26	6	3	1	2	3	5	4	15	50	35	SICL	0
			2	1	0	1	1	1	0	1	1		0
Aegj	26-37	1	3	1	2	4	5	4	15	49	36	SICL	0
			--	--	--	--	--	--	--	--	--		--
$Btgj_1$	37-47	2	4	1	1	3	4	3	I1	42	49	SIC	0
			3	1	1	2	4	3	9	2	12		0
$Btgj_2$	47-52	3	10	2	1	3	6	5	18	47	36	SICL	2.8
			4	1	0	1	1	1	3	3	6		4.5
Ckgj	52+	6	8	2	1	2	4	5	14	50	36	SICL	44.6
			3	1	1	0	1	1	0	1	1		6.2

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.11	.11	.02	.46	.33	.12	22.9	5.2	0.5	12	7.3	7.2	6.0	
	.03	.01	0	.03	.01	.02	2.0	0.2	0	2	0.1	0.1	0.3	
Aegj	.04	.05	0	.34	.30	.04	19.0	5.1	0.5	3	7.4	7.1	1.8	
	-	-	-	-	-	-	-	-	-	-	-	-	-	
$Btgj_1$	06	.11	0	.35	.36	.07	23.3	5.3	0.5	2	7.6	7.2	2.6	
	.02	.02	0	.04	.04	-	5.3	0	0.1	1	0.1	0.0	0.7	
$Btgj_2$	02	.06	0	.13	.20	.07	21.3	5.1	0.4	2	7.7	7.4	1.1	
	.01	.05	0	.11	.04	.01	4.9	0.4	0	0	0.2	0.1	0.3	
Ckgj	0	.01	0	.07	.03	.02	28.9	3.8	0.3	2	8.0	7.6	0.3	
	0	0	0	.01	.02	.01	1.7	0.6	0.0	0	0.1	0.1	0.0	

ANALYTICAL DATA SITE 3.3 SERIES 234

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-24	6	4	2	2	4	6	6	20	51	30	SICL-	2.5
			I	1	0	0	0	1	0	1	1	CL	1.0
Ae	24-30	1	8	2	3	4	7	6	22	56	22	SIL	0.0
			-	-	-	-	-	-	-	-	-		-
Bt	30-50	3	2	-	-	-	-	-	10	36	55	C	2.3
			1						1	1	1		0.6
BCk	50-55	2	6	-	-	-	-	-	14	48	39	SI	44.9
			1						1	1	0	SICL	0.6
Ckgj	55+	6	12	2	2	2	4	4	14	50	37	SICL	51.4
			4	1	1	0	0	1	1	1	1		1.0

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
A	.06	.09	.03	.31	.20	.07	21.4	2.7	0.4	10	7.5	7.3	4.1	
Ap	.01	.06	0	.01	0	0	2.7	0.2	0	3	0.0	0.0	0.2	
Ae	0	.07	.01	.32	.17	.07	23.0	1.5	0.2	4	7.7	7.3	1.2	
Bt	-	--	--	.36	.30	.09	35.8	4.1	0.5	3	7.8	7.5	1.0	
Bt	-	--	--	.01	-	.01	2.0	0.0	0.0	0	0.1	0.1	0.3	
BCk	-	--	--	.14	.11	.01	31.5	2.9	0.3	3	8.1	7.7	0.6	
	-	--	--	0	.0	0	0.7	0.1	0	0	0.1	0.0	0.0	
Ckg	0	.01	0	.09	.07	0	29.5	2.6	0.2	2	8.1	7.6	0.5	
	0	0	0	.04	.01	.01	0.3	0.1	0	0	0.0	0.1	0.2	

ANALYTICAL DATA SITE 3.4 SERIES 225

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-17	2	0	--	--	--	--	--	7	71	23	SIL	0.5
			0						1	1	0		0.7
Aegj	17-30	2	0	--	--	--	--	--	8	74	19	SIL	0.3
			0						1	0	1		0.1
Btgj	30-60	2	0	--	--	--	--	--	5	61	35	SICL	0.0
			0						1	3	2		0.0
BCgj	60-80	2	0	--	--	--	--	--	4	62	34	SICL	0.0
			0						0	1	1		0.0
Ckgj	80-90	1	0	--	--	--	--	--	6	74	20	SIL	29.2
			0						-	--	--		
IICkgj	90+	2	10	--	--	--	--	--	14	52	35	SICL	52.7
			2						1	0	1		0.3

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.12	.07	.03	.37	.18	.08	17.8	3.1	0.3	16	7.4	7.2	3.2	
	.01	.01	0	.02	.01	.0)	1.1	0.1	0	1	0.1	0.1	0.4	
Aegj	.12	.08	0	.39	.20	.12	9.0	2.7	0.1	5	7.5	7.0	0.4	
	0	.05	.01	.05	.04	.05	0	0	0	1	0.1	0.1	0.0	
Btgj	.11	.03	0	.36	.02	.04	18.0	5.3	0.3	8	7.4	7.0	0.2	
	0	.02	0	.06	.01	.01	0	0	0	2	0.1	0.1	0.1	
BCgj	.06	.05	0	.21	.17	.06	18.0	5.3	0.2	5	7.4	7.1	0.2	
	.01	0	0	.01	.01	.01	0	0	0	1	0.1	0.1	0.0	
Ckgj	0	.02	0	.11	.08	.02	26.0	4.2	0.2	2	7.9	7.5	0.0	
	--	--	--	--	--	--	--	--	--	--	--	--	--	
IICkgj	0	.01	0	.11	.05	.01	27.0	4.1	0.2	2	8.0	7.6	0.1	
	0	0	0	.01	0	0	0	0.2	0	0	0.1	0.1	0.1	

ANALYTICAL DATA SITE 3.6 SERIES 234 (eroded phase)

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)										$CaCO_3$ (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002	Texture	
Apk	0-12	2	10	-	-	-	-	-	90	60	31	SICL	2.7
										1	I		0.9
Btk	12-25	2	2	-	-	-	-	-	91	43	49	SIC	0.4
Ck	25+	2	135	-	-	-	-	-	131	53	35	SICL	48.6
										1	I		3.4

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.O. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mg	Ca	Mg	K		H_2O	$CaCl_2$		
Apk	.11	.04	0	.31	.19	.05	26.0	3.4	0.7	56	7.5	7.3	3.2	
	.01	0	.01	.04	.01	.01	4.2	0.5	0.1	1	0.0	0.0	0.0	
Btk	.11	.03	0	.33	.25	.07	36.8	4.7	0.4	8	7.8	7.5	0.8	
	.05	.01	0	.01	0	0	1.8	0.8	0	0	0.1	0.1	0.2	
Ck	0	.01	0	.12	.07	.02	30.3	3.4	0.2	4	8.1	7.7	0.1	
	.01	0	0	.03	.01	.01	1.1	0.5	0	1	0.1	0.1	0.1	

ANALYTICAL DATA SITE 3.7 SERIES 216

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%. size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-20	6	0	-	-	-	-	-	2	60	3	SI CL	0.6
			0						0	1	1		0.1
Bg	20-50	6	0	-	-	-	-	-	2	56	43	SIC	3,0
			0						0	1	1		1.3
Ck	50+	6	0	-	-	-	-	-	2	73	25	SIL	37.4
			0						0	2	1		2.3

HORIZON	NA-PYRO PHOSPHATE EXTRACTION)%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (rneq/100g)			P (m)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	MI	Fe	AI	Mn	Ca	Mn	K		H_2O	$CaCl_2$		
Ap	.04	.09	0	.33	.27	.01	24.9	4.4	0.2	13	7.7	7.4	3.3	
	.03	.02	0	.04	.01	0	1.4	0.1	0	1	0.0	0.1	0.3	
Bg	.10	.04	0	.28	.18	.01	24.8	4.6	0.2	1	8.0	7.5	0.6	
	.02	.01	0	.01	.01	0	3.5	0.2	0	1	0.1	0.1	0.1	
Ce	.01	.01	0	.14	.05	.01	25.5	3.5	0.2	5	8.1	7.7	0.3	
	.01	0	0	.02	.0)	0	0.8	0.2	0	5	0.1	0.1	0.2	

ANALYTICAL DATA SITE 4.1 SERIES 026

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Grave) >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25.0	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0 - 30	16	0	1	1	3	6	7	18	47	35	SICL	0.3
			1	0	1	1	1	0	1	1	1		0.6
Bg_1	30- 55	16	2	0	1	6	10	9	25	37	39	CL-C	0.1
			1	1	0	1	1	2	3	1	3		0
Bg_2	55-90	1	3	0	1	2	4	5	12	35	53	C	1.4
			-	-	-	-	-	-	-	-	-		-
Ckg	90- 110	16	13	1	1	5	10	10	26	44	30	CL	26.4
			10	1	1	1	1	2	4	2	5		11.6
IICkg	110+	1	59	-	-	-	-	-	65	28	7	VG CSL	47.8
			-	-	-	-	-	-	-	-	-		

HORIZON	NA-PYRO PHOSPHATE EXACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	*Mn*	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	-	-	-	-	-	-	18.2	5.2	0.5	4	6.8	6.6	6.1	49.3
	-	-	-	-	-	-	1.6	0.2	0.1	1	0.3	0.2	0.5	--
Bg_1	-	-	-	-	-	-	16.3	5.1	0.4	2	7.3	7.0	0.7	32.3
	-	-	-	-	-	-	1.4	0.1	0.0	0	0.1	0.1	0.5	--
Bg_2	-	-	-	-	-	-	15.5	5.3	0.3	3	7.6	7.1	0.8	
	-	-	-	-	-	-	-	-	-	-	-	-	-	--
Ckg	-	-	-	-	-	-	27.1	3.2	0.3	3	8.0	7.5	0.4	
	-	-	-		-	-	2.8	0.7	0.1	1	0.2	0.1	0.1	
IICkg	-	-	-	-	-	-	24.0	2.5	0.2	-	8.3	7.5	0.3	
	-	-	-	-	-	-	-	-	-	-	-	-	-	

ANALYTICAL DATA SITE 4.2 SERIES 025

HORIZON	MODAL DEPTH (cm)	NO. cf REPLICATES	PARTICLE SIZE DISTRIBUTION (%, Size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-30	1	1	1	1	3	6	11	22	55	23	SIL	1.0
Aegj	30-36	I	2	0	2	5	8	9	24	49	27	L-CL	0.2
Btgj	36-48	1	1	I	1	3	6	6	16	37	48	C	1.1
Ckgj	48+	1	7	7	2	3	4	5	15	57	28	SICL	40.3
Ckgj	(coarse textured portions)	1	11	1	2	6	13	13	35	43	23	L	43.5

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.07	.07	--	.39	.19	.05	11.5	1.7	0.2	8	7.7	7.3	3.7	32.6
Aegj	.16	.06	--	.45	.20	.05	9.5	1.1	0.2	4	7.6	---	1.0	--
Btgj	.06	.04	--	.30	.24	.05	15.0	0.8	0.3	5	7.7	7.4	0.8	34.8
Ckgj	--	--	--	--	--	--	11.5	---	0.1	2	---	---	0.2	
Ckgj	--	--	--	.14	.04	0	10.5	---	0.1	2	8.1	7.6	0.2	

ANALYTICAL DATA SITE 4.3 SERIES 024

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-20	1	1	0	1	3	5	9	18	55	27	SICL	0.4
Aegj	20-25	1	2	1	1	3	5	6	15	48	37	SICL	1.0
Btgj	25-60	1	2	1	I	3	6	5	16	38	46	C	0.2
Ckgj	60+	1	5	1	1	3	5	6	17	44	39	SICL	39.6

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.06	.07	--	.40	.23	.06	13.8	1.6	0.3	9	7.3	7.0	3.8	35.7
Ae	.18	.12	--	.43	.24	.01	11.5	1.8	0.2	3	7.2	6.8	1.5	19.6
Bt	.03	.01	--	.30	.21	.05	11.5	2.1	0.3	5	7.5	7.1	0.6	33.8
Ck	.00	.01	--	.13	.07	.01	28.0	2.1	0.3	2	8.0	7.6	0.3	

ANALYTICAL DATA SITE 4,4 SERIES 013

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-25	2	2	0	I	4	12	15	32	50	19	SIL-L	1.7
			0	0	1	0	0	1	1	0	1		0 2
Ae_1	25-30	1	1	0	1	4	11	14	30	57	13	SIL	0.3
			-	-	-	-	-	-	-	-	-		-
Ae_2	30-35	2	3	1	1	5	12	15	33	54	14	SIL	0.2
			0	1	0	1	1	1	4	3	1		0.1
Bt	35-70	2	2	I	1	4	12	13	29	44	28	CL	3.7
			1	I	1	1	0	1	1	3	1		1.3
Ck	70+	2	6	1	2	4	12	16	34	50	17	L-	36.8
			3	1	1	0	1	0	3	2	1	SIL	0.6

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P {ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mg	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	0.06	.04	--	.44	.20	.06	10.8	1.7	0.2	22	7.5	7.1	2.8	27.6
	.01	.01	--	.06	.01	0	0.4	0.0	0.0	2	0.2	0.1	0.6	--
Ae_1	0.17	.14	-	.63	.31	.17	7.0	-	0.1	6	7.8	7.3	1.2	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ae	.09	.05	--	.41	.17	.06	6.0	1.5	0.1	6	7.7	7.2	0.5	13.9
	.01	.01	--	.05	.01	.02	0.7	0.1	0.0	1	0.1	0.0	0.1	--
Bt	.08	.03	--	.37	.21	.07	14.0	1.7	0.2	4	7.8	7.4	0.5	22.3
	.04	.00	--	.05	0	.01	4.2	0.0	0.0	1	0.0	0.1	0.1	--
Ck	.01	.01	--	.13	.06	.01	13.5	1.7	0.1	1	8.1	7.5	0.1	
	.01	.01	--	.02	.01	0	4.9	0.0	0.0	0	0.0	0.1	0.0	

ANALYTICAL DATA SITE 4.5 SERIES 025

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-20	20	1	1	2	2	5	8	17	60	22	SIL	0.5
			1	0	0	0	1	1	1	2	2		0.6
Aegj	20-30	1	1	0	1	3	4	15	23	54	23	SIL	0.1
			-	-	-	-	-	-	-	-	-		-
Btgj	30-40	20	2	1	2	4	8	8	22	52		SIL-CL	
			1	0	1	1	2	2	4	7	24		2.4
Ckgj	40+	20	9	1	1	4	9	9	25	48	28	CL	37.8
			2	0	1	1	0	1	1	1	1		1.7

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mg	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	-	-	-	-	-	-	12.5	3.2	0.1	4	7.2	7.0	4.2	30.5
							0.8	0.1	0.0	0	0.3	0.1	0.2	--
Aegj	-	-	-	-	-	-	7.5	2.3	0.2	3	7.8	7.1	1.0	
Btgj	-	-	-	-	-	-	19.3	4.1	0.2	2	7.8	7.4	1.0	20.9
							6.7	0.8	0.0	0	0.1	0.1	0.3	--
Ckgj	-	-	-	-	-	-	27.8	3.3	0.2	2	8.2	7.6	0.3	
							1.4	0.2	0.0	1	0.1	0.1	0.1	

ANALYTICAL DATA SITE 4.6 SERIES 024

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5.1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-15	20	3	1	1	4	6	10	23	48	29	CL	0.2
			2	1	1	1	1	2	2	2	1		0.1
Ae	15-20	1	4	0	3	8	13	2	26	52	23	SIL	0.0
			-	-	-	-	-	-	-	-	-		-
Bt	20-55	20	1	0	1	1	3	3	12	43	45	SIC	0.7
			2	1	1	2	3	3	3	4	4		0.8
Ck	55+	17	13	2	3	4	8	6	23	46	31	CL	12.1
			3	1	1	1	0	0	3	2	4		11.5

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	-	-	-	-	-	-	11.2	4.0	0.6	6	7.2	6.3	5.4	37.9
							0.7	0.4	0.2	2	0.2	0.1	0.3	--
Ae	-	-	-	-	-	-	8.5	3.0	0.5	3	7.0	6.7	1.5	
Bt	-	-	-	-	-	-	17.0	4.9	0.4	1	7.4	7.0	0.9	30.5
							6.3	0.3	0.0	0	0.2	0.2	0.1	--
Ck	-	-	-	-	-	-	30.5	4.7	0.3	2	8.0	7.5	0.5	
							5.5	0.6	0.1	1	0.1	0.1	0.1	

ANALYTICAL DATA SITE 5.1 SERIES 046

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in nun)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-30	6	2	1	1	4	8	11	24	52	24	SIL	0.1
			2	1	0	1	1	1	1	1	1		0.1
Aejg	30-50	6	2	I	1	5	11	14	32	48	21	L	0.1
			1	1	1	1	2	1	(3)	2	1		0.2
$Btjg_1$	50- 70	6	2	I	2	5	9	12	27	49	24	L-	0.1
			1	0	1	1	1	1	2	2	1	SIL	0.1
$Btjg_2$	70-90	1	3	0	1	4	10	15	30	45	25	L	0.1
			-	-	-	-	-	-	-	-	-		-
Ckg	90+	6	6	2	2	4	8	12	27	55	18	SIL	25.8
			1	1	1	I	1	1	2	2	2		6.8

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	M	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.18	.21	--	.62	.37	.03	15.0	1.7	0.1	17	7.2	6.8	5.0	41.6
	.01	.04	--	.05	.02	0	-	-	-	-	0.1	0.1	0.2	--
Aejg	.15	.17	--	.56	.28	.02	10.0	-	0.1	14	7.2	6.8	1.6	27.2
	.04	.02	--	.05	.03	0	--	-	-	-	0.1	0.1	0.2	--
$Btjg_1$	.21	.06	--	.73	.16	.01	24.0	-	0.2	17	7.5	7.0	0.6	20.8
	.04	.01	--	.26	.02	0	--	-	-	-	0.1	0.1	0.2	--
$Btjg_2$	.15	.05	--	49	.13	.01	8.5	-	0.1	16	7.6	7.0	0.6	
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ckg	.02	.01	--	.15	.05	0	25.0	1.6	0.2	11	8.0	7.4	0.2	
	.02	0	--	.04	.01	.01	--	-	-	-	0.1	0.0	0.1	

ANALYTICAL DATA SITE 5.2 SERIES 043 (taxad junct)

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-22	6	3	1	3	6	9	12	30	53	18	SIL	0.2
			-	1	0	0	1	1	1	1	1		0.2
Aej	22-27	1	3	1	1	5	9	10	26	56	19	SIL	0.1
			-	-	-	-	-	-	-	-	-		-
Btj	27-55	6	4	2	3	7	15	16	42	40	19	L	0.1
			-	2	1	1	2	3	6	6	2		0.5
Ck	55+	6	8	2	4	9	16	14	44	43	14	L	26.5
			-	1	1	1	2	2	3	2	1		2.3

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			(ppm)	pH		ORGANIC MATTER (%)	C.E.O. (meq/100g)
	Fe	Al	Mn	Fe	A!	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.12	.06	--	.42	.21	.07	11.6	1.7	0.4	27	6.9	6.6	3.2	28.3
	.01	.01	--	.02	.01	0	1.3	0	0.1	12	0.3	0.2	0.2	--
Aej	.16	.07	--	.53	.22	.06	7.2		0.2	3	7.3	6.7	0.8	22.5
	0	--	--	-	-	-	-		-	-	-	-	-	--
Bt	.04	.02	--	.33	.17	.06	10.3	1.7	0.2	1	7.6	7.2	0.4	19.4
	.01	0	--	.05	.01	.01	3.2	0.0	0.0	0	0.2	0.1	0.1	--
Ck	0.0	.01	--	.13	.06	.02	31.3	1.7	0.1	1	8.0	7.4	0.4	
	0	0	--	.02	.01	0	1.0	0.0	0.0	1	0.0	0.1	0.0	

ANALYTICAL DATA SITE 5.3 SERIES 0145

HORIZON	MODAL DEPTH (cm)	NO of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-25	1	2 -	0 -	1 -	4 -	7 -	10 -	21 -	60 -	18 -	SIL	0.3
Aegj	25-30	1	3 -	0 -	2 -	6 -	11 -	14 -	33 -	56 -	11 -	SIL	0.2
Btgj	30-48	1	1 -	1 -	3 -	8 -	15 -	12 -	38 -	41 -	21 -	L	0.5
Ckgj	48+	1	14 -	1 -	3 -	8 -	15 -	14 -	41 -	47 -	12 -	L	32.8

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.O. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.15	.09	--	.40	.21	.04	11.5	--	0.2	25	7.3	6.9	3.9	34.0
Aegj	.08	.06	--	.31	.13	.03	6.5	1.2	0.1	3	7.6	7.3	.6	13.1
Btgj	.06	.03	--	.30	.17	.05	10.5	1.7	0.1	2	7.6	7.3	.5	20.8
Ckgj	..0	.01	--	.09	.04	.01	23.0	1.2	0.1	1	8.1	7.6	.1	

ANALYTICAL DATA SITE 5.4 SERIES 045

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-18	2	1	1	1	3	6	8	18	63	19	SIL	0.1
			0	1	0	0	0	1	0	0	0		0.3
$Btgj_1$	18-35	2	6	0	2	6	11	12	31	51	19	SIL	0.1
			4	0	1	1	4	1	6	8	1		0.5
Btg_2	35- 60	2	3	0	1	6	11	13	31	49	21	L	0.7
			1	0	0	0	0	1	1	1	1		0.8
Ckgj	60+	2	16	3	4	9	15	12	42	46	13	L	33.8
			3	1	0	1	0	1	2	1	1		0.5

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			(ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.19	.12	--	.42	.19	.06	9.3	1.6	0.3	26	6.6	6.2	3.9	33.4
	.16	.13	--	.40	.20	.06	0.4	0.0	0.0	14	0.1	0.1	0.3	--
$Btgj_1$	.13	.06	--	.34	.16	.05	7.8	1.5	0.1	4	7.3	6.8	0.8	20.2
	.07	.04	--	.05	.02	.01	1.1	0.0	0.0	0	0.1	0.2	0.1	--
Btg_2	.07	.05	--	.35	.15	.05	8.3	1.7	0.1	4	7.5	7.2	0.6	20.7
	.01	.01	--	.04	.01	0	1.1	0.0	0.0	0	0.4	0.0	0.1	--
Ckgj	.00	.01	--	.09	.04	.01	20.5	1.3	0.1	4	8.2	7.6	0.2	
	.01	.00	--	.01	.01	0	0.7	0.0	0.0	2	0.0	0.1	0.1	

ANALYTICAL DATA SITE 5.5 SERIES 053

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-25	2	3	0	1	6	9	12	27	58	15	SIL	0.2
			0	0	0	0	0	1	1	1	1		0.1
Ae	25-30	2	5	0	0	4	7	13	24	64	12	SIL	0.1
			5	0	0	0	0	3	3	1	1		0
Bt	30-60	2	17	2	4	13	19	12	48	28	25	L-SCL	4.2
			4	1	1	2	2	0	4	3	1		0.2
Ck	60- 65	1	13	3	5	11	18	13	49	38	13	L	25.3
			-	-	-	-	-	-	-	-	-		-
IICk	65+	2	25	2	4	20	32	15	72	24	5	GFSL	24.9
			3	1	1	3	0	1	2	2	0		2.2

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.16	.11	--	.53	.24	.09	7.5	1.7	0.1	10	6.2	6.5	2.9	24.9
	.02	.00	--	.01	.01	.01	0.0	0	0	0	0.3	0.7	0.1	--
Ae	.19	.12	--	.47	.21	.05	5.5	1.4	0.1	12	6.5	6.0	0.6	16.9
	.06	.05	--	.07	.04	0	0.7	0.3	0.0	2	0.1	0.0	0.3	--
Bt	.04	.02	--	.54	.20	.07	13.0	1.7	0.2	12	7.8	7.2	0.5	24.9
	0	.0-	--	.08	.02	.01	1.1	0.0	0.0	4	0.1	0.1	0.1	--
Ck	0	.01	--	.15	.04	.02	22.0	1.2	0.2	6	8.1	7.5	0.3	
	--	--	--	--	--	--	--	--	--	--	--	--	--	
IICk	.00	.01	--	.13	.04	.02	22.5	0.9	0.1	6	8.0	7.3	0.2	
	.01	.00	--	.04	.01	.01	7.8	0.1	0.0	1	0.1	0.2	0.1	

ANALYTICAL DATA SITE 5.6 SERIES 043

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-28	2	1	0	1	5	9	12	27	60	14	SIL	0.2
			0	0	1	0	1	3	4	4	0		0.1
Ae	28-50	2	1	0	1	3	5	9	16	74	10	SIL	0.1
			0	0	1	1	1	1	0	0	0		0.1
Bt	50-100	2	4	1	2	7	14	15	37	45	18	L	0.2
			2	1	0	1	2	2	1	4	3		0.1
Ck	100-120	1	7	2	4	10	17	16	49	40	11	L	20.0
			-	-	-	-	-	-	-	-	-		-
IICk	120+	2	0	2	24	51	15	4	94	4	2	S	35.3
			0	1	6	4	1	1	1	1	0		--

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.13	.09	--	.48	.32	.07	9.0	1.7	0.5	50	7.2	6.9	3.1	28.0
	.02	.01	--	.06	0	.01	-	-	-	--	0.1	0.1	0.1	--
Ae	.21	.18	--	.61	.31	.11	4.0	1.2	0.1	28	6.3	5.9	0.9	17.4
	.05	.00	--	.03	.06	.01	-	-	-	--	0.3	0.1	0.2	--
Bt	.08	.06	--	.39	.14	.05	5.0	1.7	0.2	18	5.7	5.0	0.2	16.3
	.02	.01	--	.07	.02	.01	-	-	-	--	0.2	0.2	0.1	--
Ck	.01	.01	--	.13	.05	.02	20.0	1.6	0.4	10	8.0	7.4	0.2	
	--	--	--	--	--	--	-	-	-	--	0.1	0.2	0.1	
IICk	0	0	--	.05	.01	0	17.0	0.5	0.1	2	8.0	7.4	0.1	
	0	0	--	.01	0	.01	-	-	-	1	0.1	0.2	0.0	

ANALYTICAL DATA SITE 10.1 SERIES 266

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-15	6	1	1	1	2	4	4	12	49	38	SICL	0
			0	0	0	1	1	1	1	1	1		0
Bg	15-40	6	0	-	-	-	-	-	9	40	50	SIC-C	0
			0						2	7	8		0
Ckg	40+	6	0	-	-	-	-	-	4	38	59	C- HC	23.4
			0						1	2	1		1.7

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.26	.09	0	.55	.17	.03	14.0	5.3	0.3	10	7.1	6.7	3.5	
	.05	.02	0	.02	.01	.01	0.5	0.0	0.0	1	0.1	0.1	0.2	
Bg	.13	.04	0	.44	.19	.08	18.2	5.3	0.3	6	7.2	6.8	1.0	
	.05	.02	0	.07	.02	.04	4.5	0.0	0.0	3	0.2	0.2	0.9	
Ckg	0	.01	0	.17	.09	0.02	30.0	5.3	0.3	1	8.0	7.8	0.2	
	0	0	.01	.02	.01	0.00	1.4	0.0	0.0	0	0.1	0.0	0.1	

ANALYTICAL DATA SITE 10.2 SERIES 265

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-17	6	0	9*	6*	3	4	3	25	42	34	CL	0.3
			0	2	1	1	1	0	2	1	1		0.2
Aegj	17-22	1	3*	9*	7*	4	4	3	26	45	29	CL	0.2
			-	-	-	-	-	-	-	-	-		-
$Btgj_1$	22-30	1	0	2	2	2	4	2	11	44	45	SIC	0.4
			-	-	-	-	-	-	-	-	-		-
$Btgj_2$	30-53	6	0	-	-	-	-	-	5	36	59	C	0.2
									1	2	1		
Ckg	53+	6	3	-	-	-	-	-	5	43	52	SIC	22.6
			2						1	2	3		4.8

* Iron concretions contributed to the gravel and coarse sand fractions

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.50	.23	.02	3.09	.38	.41	7.8	2.3	0.5	33	5.3	5.0	4.8	
	.06	.06	.01	0.37	.03	.15	1.4	0.3	0.1	3	0.3	0.4	0.2	
Aegj	.34	.01	.01	1.85	.27	.19	6.0	3.3	0.3	24	5.5	5.0	0.3	
	-	-	-	-	-	-	-	-	-	-	-	-	-	
$Btgj_1$	.22	.09	0	1.26	.22	.13	11.5	5.3	0.4	16	6.2	5.8	1.0	
	-	-	-	-	-	-	-	-	-	-	-	-	-	
$Btgj_2$	.09	.02	0	0.42	.21	.09	17.7	5.3	0.5	9	6.9	6.7	1.3	
	.03	.01	0	0.12	.01	.02	2.2	0	0	4	0.2	0.3	0.7	
Ckg	0	.01	0	0.17	.11	.03	27.4	5.3	0.3	3	8.0	7.8	0.7	
	0	.01	0	0.03	.02	.01	1.2	0	0	1	0.1	0.1	0.4	

ANALYTICAL DATA SITE 10.3 SERIES 265

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (4)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-15	2	1	2	1	3	5	3	14	43	44	SIC	0.3
			0	0	0	0	0	0	1	1	1		0.1
Aegj	15-20	1	0	-	-	-	-	-	5	41	54	SIC	0.2
			0						-	-	-		-
Btgj	20 -45	2	0	-	-	-	-	-	3	33	64	HC	0.1
			0						0	4	4		0.1
Ckgj	45+	2	0	-	-	-	-	-	2	36	62	HC-SIC	17.6
			0						1	10	9		0.6

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	M!	Fe	Al	Mg	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.27	.12	.02	1.77	.34	.24	11.3	4.9	0.6	11	6.1	5.8	2.6	
	.01	.03	0	.12	.01	.03	2.5	0.7	0	1	0.4	0.2	1.6	
Aegj	.35	.10	0	1.26	.29	.03	12.3	5.3	0.4	3	6.2	5.8	1.8	
	--	--	--	--	--	--		-	-	-	-	-	-	
Btgj	.11	.04	0	.50	.24	.07	18.5	5.3	.4	4	7.1	6.8	0.8	
	.03	.01	0	.12	.01	.04	0	0	0	1	0.1	0.2	0.1	
	0	0	0	.22	.12	.02	25.3	5.3	.2	1	8.0	7.8	0.3	
	.01	.01	0	.01	.01	0	0.4	0	0	0	0.0	0.0	0.2	

ANALYTICAL DATA SITE 10.4 SERIES 264

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-15	2	1	-	-	-	-	-	5	44	52	SIC	0.3
			0						0	3	4		0.1
Bt_1	15-40	2	0	-	-	-	-	-	2	32	66	HC	
			0						0	3	3		0.1
Bt_2	40-42	1	0	-	-	-	-	-	1	24	75	HC	0.2
			0						-	-	-		
Ck	42+	2	0	-	-	-	-	-	2	37	61	HC	20.1
			0						1	0	0		3.9

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mg	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.22	.08	.01	.52	.22	.08	15.1	5.1	0.6	34	6.6	6.0	3.6	
	.01	.01	0	.05	.00	.01	1.9	0.4	0.1	2	0.7	0.1	0.1	
Bt_1	.25	.09	0	.42	.25	.05	20.0	5.1	0.4	6	5.9	5.7	1.2	
	.06	.04	0	.03	0	.02	1.4	0.1	0	1	0.4	0.6	0.1	
Bt_2	.09	.04	0	.30	.24	.05	21.0	4.7	0.3	5	6.9	6.6	1.1	
	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ck	.02	.01	0	.25	.12	.02	29.8	4.1	0.3	3	7.9	7.5	0.7	
	.01	0	0	.06	.03	.01	0.4	0.6	0	2	0.1	0.0	0.0	

ANALYTICAL DATA SITE 10.5 SERIES 255

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	ES .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay. < .002		
Ap	0-15	2	1	-	-	-	-	-	8	55	38	SICL	1.4
			0						0	0	1		0.1
Aegj	15-25	2	1	-	-	-	-	-	8	56	37	SICL	0.5
			0						0	1	1		0
Btgj	25-50	2	0	-	-	-	-	-	4	48	49	SIC	0.1
			0						1	1	1		0.1
Ckgj	50-62	1	0	-	-	-	-	-	3	57	40	SICL	15.0
			-						-	--	--	-SIC	-
IICkgj	62+	2	1	-	-	-	-	-	5	68	27	SIL-	18.0
			0						1	1	0	SICL	4.0

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.10	.04	.01	.64	.22	.08	18.0	5.0	0.2	16	7.6	7.3	3.3	
	.01	0	0	0	0	0	0.4	0.5	0.1	2	0.1	0.0	0.1	
Aegj	.13	.05	0	.66	.23	.10	15.8	5.0	0.2	10	7.5	7.2	3.0	
	.04	.01	.01	.04	.01	.0	1.1	0.1	0	1	0.1	0.1	0.4	
Btgj	12	.05	0	.36	.24	.09	19.8	4.5	0.2	6	7.2	7.1	0.8	
	.01	.01	0	.05	.0	0	1.8	0.2	0	4	0.1	0.1	0.0	
Ckgj	.01	.01	0	.22	.15	.06	32.0	3.3	0.2	2	8.0	7.7	0.4	
	--	--	-	--	--	--	--		1	--	--	--	--	
IICkgj	0	.01	0	.21	.11	.05	28.5	3.1	0.2	1	8.0	7.7	0.5	
	.01	0	0	.01	.02	.01	2.1	0.1	0.0	0	0.2	0.1	0.1	

ANALYTICAL DATA SITE 10.6 SERIES 265

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-15	2	0	-		-	-	-	9	62	29	SICL	0
			0						0	1	1		0
Aegj	15-25	2	1	-	-	-	-	-	5	53	43	SIC	0
			1						3	4	6		0
Btgj	25-55	2	0	-	-	-	-	-	3	36	62	HC	0
			0						1	1	1		0
Ckgj	55+	2	2	-	-	-	-	-	2	37	62	HC	26.1
			1						1	1	1		1.1

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.18	.05	0	.28	.19	.06	9.8	4.9	0.2	3	7.0	6.6	3.6	
	.03	.01	.01	.32	.01	.02	1.8	0.4	0	2	0.1	0.1	0.1	
Aegj	.28	.09	0	.26	.24	.02	8.5	5.3	0.3	1	6.0	5.6	1.5	
	.02	.04	0	.34	.04	.01	0.7	0	0	0	0.1	0.1	0.6	
Btgj	.17	.07	0	.37	.25	.07	13.8	5.3	0.4	2	6.6	6.2	1.0	
	.04	.03	0	.08	.02	.01	0	0	0	1	0.5	0.4	0.2	
Ckgj	0	0	0	.21	.12	.02	21.5	5.3	0.3	1	8.0	7.7	0.5	
	0	.01	0	.04	.01	0	0.7	0	0	0	0.0	0.1	0.1	

ANALYTICAL DATA SITE 13.1 SERIES 115s

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ meq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .032-.05	Clay < .002		
Ap	0-30	6	1	0	1	10	41	28	79	13	8	LFS	0
			1	1	0	1	2	2	1	1	1		0
Aegj	30-45	6	0	0	1	11	46	22	79	14	7	LFS	0
			1	0	1	2	7	5	4	4	3		0
llBtgj	45-65	6	0	0	1	2	23	31	56	27	17	FSL	1.0
			0	1	1	0	5	4	2	2	2		0.8
LlCkgj	65+	6	1	1	1	2	21	33	56	32	12	VFSL	16.9
			1	1	0	1	6	4	4	5	2		6.2

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meg/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mn	K		H_2O	$CaCl_2$		
Ap	.08	.08	-	.30	.24	.01	7.2	1.4	0.7	42	6.7	6.3	1.8	19.2
	.02	.04		.02	.12	0	0.3	0.5	0.2	21	0.0	0.2	0.1	--
Aegj	.08	.03	-	.17	.18	.01	3.9	0.8	0.5	6	6.9	6.2	0.3	6.9
	.03	.01		.03	.27	.01	1.6	0.5	0.1	1	0.2	0.1	0.1	-
llBtgj	.04	.01	-	.18	.11	.05	8.8	1.6	0.3	2	7.8	7.3	0.4	15.1
	.01	.00		.02	.01	.01	1.5	0.1	0.2	1	0.2	0.1	0.0	-
llCkgj	.01	.01	-	.12	.05	.02	15.0	1.5	0.1	3	8.0	7.5	0.3	
	.01	.01		.03	.01	.01	1.1	0.1	0.0	2	0.1	0.0	0.2	

ANALYTICAL DATA SITE 13.2 SERIES 105

HORIZON	MODAL DEPTH (cm)	NO. Of REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel >2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay <.002		
Ap	0-25	6	2	1	3	29	42	10	84	10	6	LFS	0.1
			1	0	1	3	3	2	1	1	1		0.1
Bm	25-55	6	1	1	2	29	53	7	93	4	3	FS	0
			1	1	1	6	7	3	2	1	1		0
Bg	55- 95	6	0	0	1	22	55	16	94	3	3	FS	0
			0	0	1	5	4	6	1	1	1		0
BCg	95-100	1	0	0	0	19	65	10	93	3	4	FS	0.2
Ckg	110+	6	0	0	1	1	14	59	76	18	6	VFSL	17.4
			0	1	0	1	8	5	4	4	1		2.0

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
Ap	.04	.12	-	.32	.36	0	3.5	0.4	0.6	53	5.5	5.0		16.4
	.00	.01		.02	.02	0	0.3	0.1	0.0	5	0.1	0.1	0.2	-
Bm	.04	.09	-	.23	.28	0	2.1	0.2	0.3	4	6.5	5.7	0.6	10.6
	.02	.02		.02	.04	0	0.5	0.0	0.0	0	0.2	0.1	0.2	-
Bg	.04	.04		.25	.15	.02	1.3	0.2	0.2	4	6.2	6.0	1.1	6.6
	02	.02	-	.08	.06	.01	0.4	0.1	0.0	1	0.7	0.3	2.3	-
BCg	.02	.01	-	.15	.03	.02	2.6	0.4	0.2	3	7.0	6.5	0.1	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ckg	.01	0	-	.03	.03	.01	25.7	1.0	0.2	1	8.1	7.5	0.3	
	00	0		.02	.01	.01	1.0	0.1	0.0	0	0.1	0.1	0.1	

ANALYTICAL DATA SITE 13.3 SERIES 115s (texadjunct)

HORIZON	MODAL DEPTH (cm)	NO. of REPLICATES	PARTICLE SIZE DISTRIBUTION (%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0-21	6	0	0	1	6	41	26	74	18	8	FSL-	0.2
			0	1	1	1	4	4	1	1	0	LFS	0
$Aegj_1$	21-32	1	0	0	0	7	46	33	86	11	3	LFS-	0.
			-	-	-	-	-	-	-	-	-	FS	-
$Aegj_2$	32-53	6	0	0	1	4	37	40	83	13	4	LES	0
			0	1	0	3	5	6	5	3	1		0
llBtgj	53 -63	1	0	0	0	1	17	45	63	19	18	VFSL	0.1
			-	-	-	-	-	-	-	-	-		-
llBtg	63-86	6	0	0	1	1	7	33	44	40	17	L	0.2
			0	1	1	1	7	7	13	13	1		0.3
llCkg	86+	6	0	1	0	1	4	36	41	47	12	L	6.9
			0	1	0	0	1	6	7	4	2		6.3

HORIZON	NA-PYRO PHOSPHATE EXTRACTION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mn	Ca	Mg	K		H_2O	$CaCl_2$		
A p	.05	.04	--	.26	.20	.02	5.3	1.0	0.5	12	7.6	7.1	1.2	13.2
	.01	.01		.03	.01	.02	2.3	0.1	0.1	--	0.1	0.1	0.1	--
$Aegj_1$	.13	.10	--	.34	.39	.00	2.3	0.2	0.2	4	7.4	7.2	0.9	--
	--	-		--	--	--	--	--	--	--	--	--	--	--
$Aegj_2$	04	.0	--	.23	.16	.02	2.3	0.4	0.2	2	7.4	6.9	0.3	4.5
	.01	.03		.06	.08	02	0.6	0.1	0.1	0	0.1	0.0	0.2	
llBtgj	.06	.02	--	.24	.10	.06	3.3	0.8	0.1	3	7.6	7.2	0.3	17.4
	--	--		--	--	--	--	--	--	--	--	--	--	--
llBtg	.03	.01	--	.25	.08	.06	9.8	1.7	0.1	2	7.6	7.2	0.4	
	. 01	0		.04	.01	.03	4.5	0.0	0.0	1	0.2	0.2	0.1	-_
llCkg	.01	.00	--	.19	.05	.04	12.0	1.7	0.1	1	7.9	7.5	0.2	
	.01	.01		.08	.02	.03	4.7	0.0	0.0	0	0.1	0.1	0.1	

ANALYTICAL DATA SITE 13.4 SERIES 095

HORIZON	MODAL DEPTH (cm)	NO. cf REPLICATES	PARTICLE SIZE DISTRIBUTION(%, size in mm)									Texture	$CaCO_3$ eq (%)
			Gravel > 2	VCS 1-2	CS .5-1	MS .25-.5	FS .1-.25	VFS .05-.1	Sand .05-2	Silt .002-.05	Clay < .002		
Ap	0- 31	6	5	3	8	41	30	3	83	11	6	LS	0.1
			-	1	1	1	2	1	1	1	0		0.1
Aegj	31-61	6	7	3	8	41	31	2	84	10	7	LS	0.1
			-	1	3	2	5	1	3	2	1		0.1
Btgj	61-86	6	6	1	4	46	29	2	81	7	12	SL	0.1
			-	1	1	2	3	1	2	1	2		0.1
BCgj	86-116		samples missing										
Ckg	116+	6	0	2	6	38	45	2	92	4	4	S	8.7
			-	1	1	3	3	1	1	1	0		3.4

HORIZON	NA-PYRO PHOSPHATE EXTRACT ION (%)			OXALATE EXTRACTION (%)			EXCHANGEABLE CATIONS (meq/100g)			P (ppm)	pH		ORGANIC MATTER (%)	C.E.C. (meq/100g)
	Fe	Al	Mn	Fe	Al	Mg	Ca	Mg	K		H_2O	$CaCl_2$		
A P	.07	.08	--	.15	.13	.01	2.9	0.5	0.6	58	5.5	5.0	1.4	10.3
	.01	.0)		.07	.01	.00	0.4	0.0	0.1	2	0.2	0.2	0.2	--
Aegj	06	.02		.13	.05	.02	3.1	0.6	0.2	4	6.0	5.6	0.2	5.4
	.01	.00		.04	.00	.01	0.7	0.1	0.0	2	0.1	0.6	0.1	--
Btgj	05	.03		.11	.08	.02	6.5	1.1	0.1	2	6.6	6.0	0.4	13.5
	.00	.00	–	.02	.01	.01	1.3	0.1	0.0	0	0.2	0.2	0.1	--
BCgj	samples missing													
Ckg	.01	.01	--	.03	.03	.01	26.3	0.7	0.1	1	8.0	7.2	0.3	
	.00	.00		.01	.01	.00	1.3	0.0	0.0	0	0.0	0.1	0.1	

APPENDIX III

SELECTED ENGINEERING PROPERTIES OF SELECTED SOILS

Appendix III contains selected engineering properties of some of the soils of the subwatersheds. Site descriptions and routine analytical data for these soils are listed in Appendices I and II respectively.

The first section of Appendix III lists data that may have seasonal variation. Means (M) and standard deviations (SD) are presented. Bulk density and mass wetness means are based on three replicates per horizon per season. Vane shear values are based upon five measurements per horizon per season.

The second section of Appendix III lists data not expected to vary over seasons. Abbreviations used include:

Atterburg Limits	- W_L - liquid limit
	W_P - plastic limit
	I_P - plasticity index
Compaction	- Max. Wet Den.- Maximum wet density in grams per cubic centimeter
	- Max. Dry Den. - Maximum dry density
	- OMC - optimum moisture content
CBR Swelling	- (California Bearing Ratio)
	- Dry den. - dry density
	- MC - moisture content
PVC Swelling	- (Potential Volume Change) categories
	- NC - noncritical
	- M - moderately critical

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft.-lbs.		REMOLDED SHEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	N	SD
1.1 Ap	Spring	1.40	0.031	1.85	0.021	24.75	0.62				
	Summer	1.49	0.041	1.73	0.046	15.97	0.24	96.25	7.50	18.50	3.70
	Fall	1.44	0.021	1.82	0.023	25.87	0.40	59.40	4.39	22.0	2.12
1.1 Bg_1	Spring	1.58	0.012	1.96	0.025	23.97	0.97	43.64	5.70	13.63	1.63
	Summer	1.56	0.025	1.93	0.015	22.50	0.85	71.25	5.72	13.5	1.92
	Fall	1.55	0.035	1.91	0.031	23.75	1.25	51.8	10.43	24.4	0.89
1.1 Bg_2	Spring	1.58	0.039	1.96	0.031	23.64	1.42	53.38	5.26	16.13	1.96
	Summer	1.58	0.012	1.93	0.012	21.80	0.28	67.0	5.72	13.75	1.50
	Fall	1.54	0.064	1.91	0.039	23.34	1.49	55.63	3.62	20.25	1.49
1.1 Ckg	Spring	1.52	0.087	1.93	0.070	26.80	2.28				
	Summer	1.61	0.080	1.96	0.0529	21.83	3.34				
	Fall										
1.2 Ap	Spring	1.44	0.044	1.83	0.032	26.33	1.75	45.83	7.00	8.83	3.60
	Summer	1.22	0.087	1.45	0.108	18.68	0.26	25.0	4.09	8.25	0.50
	Fall	1.34	0.038	1.66	0.046	23.95	1.04	27.0	3.46	8.0	1.73
1.2 Bg	Spring	1.59	0.0	1.95	0.014	21.95	0.91	62.33	2.52	15.67	0.53
	Summer	1.74	0.04	2.02	0.031	15.25	0.80	75.75	5.06	20.0	0.0
	Fall	1.60	0.021	1.93	0.023	20.15	0.24	44.6	8.30	15.2	1.64
1.2 Ckg	Spring	1.74	0.006	2.06	0.006	17.60	0.77	77.0	13.41	20.67	3.61
	Summer	1.63	0.055	1.96	0.025	20.25	2.60	100.00	0.0	20.0	0.0
	Fall	1.62	0.106	1.96	0.047	19.33	1.48	61.5	14.11	15.5	1.73

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft. -lbs.		REMOLDED SHEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	M	SD
3.1 Ap	Spring	1.19	0.070	1.63	0.081	36.31	1.30				
	Summer	1.39	0.010	1.82	0.006	30.95	0.80				
	Fall	1.25	0.047	1.72	0.029	37.43	3.21				
3.1 Bg_1	Spring	1.35	0.059	1.77	0.061	30.98	1.12				
	Summer										
	Fall										
3.2 Ap	Spring	1.11	0.117	1.43	0.104	29.91	4.52				
	Summer	1.36	0.015	1.69	0.025	24.14	0.44				
	Fall	1.26	0.059	1.66	0.061	31.62	1.28				
3.2 $Btgj_1$	Spring	1.49	0.093	1.67	0.337	22.95	2.32				
	Summer	1.48	0.015								
	Fall										
3.2 Ckgj	Spring	1.49	0.047	1.97	0.042	16.69	0.81				
	Summer										
	Fall										
3.3 Ap	Spring	1.32	0.014	1.69	0.007	27.19	0.89				
	Summer	1.48	0.015	1.83	0.021	22.91	0.57				
	Fall	1.39	0.067	1.75	0.079	26.03	0.94				
3.3 Bt	Spring	1.49	0.0351	1.83	0.032	22.36	1.66				
	Summer										
	Fall										
3.3 Ckgj	Spring	1.75	0.006	2.03	0.006	16.57	0.82				
	Summer										
	Fall										

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft.-lbs.		REMOLDED SHEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	M	SD
4.2 Ap	Spring	1.25	0.038	1.57	0.050	25.66	1.73				
	Summer	1.16	0.080	1.45	0.083	13.55	1.84				
	Fall	1.36	0.068	1.67	0.057	21.93	1.85	26.0	1.41	7.60	0.89
4.2 Aegj	Spring										
	Summer	1.33	0.104	1.45	0.085	9.13	1.99				
	Fall										
4.2 Btgj	Spring							27.0	2.0	8.67	1.53
	Summer	1.17	0.087	1.37	0.068	16.95	3.61	92.50	14.43	21.0	4.0
	Fall	1.48	0.035	1.82	0.012	23.82	2.17	42.0	4.24	12.75	1.50
4.2 Ckgj	Spring	1.80	0.031	1.95	0.085	22.55	1.77	75.2	12.1	14.8	1.48
	Summer	1.79	0.071	1.97	0.076	0.72	0.16	123.75	20.22	31.25	4.79
	Fall	1.91	0.052	2.17	0.049	13.89	0.84	64.0	5.66	15.2	4.32
4.3 Ap	Spring	1.43	0.053	1.84	0.061	23.78	1.23				
	Summer	1.48	0.052	1.82	0.069	22.47	2.41	76.25	7.50	25.0	4.08
	Fall	1.48	0.038	1.87	0.006	24.43	0.39	39.75	7.41	15.75	4.65
4.3 Bt	Spring	1.56	0.061	1.89	0.072	18.68	3.85	50.0	6.45	11.83	1.17
	Summer	1.59	0.052	1.89	0.0	8.55	0.0	107.5	8.66	26.25	2.50
	Fall	1.60	0.047	1.93	0.025	20.21	2.83	51.2	8.76	15.4	0.55
4.3 Ck	Spring	1.84	0.103	2.13	0.118	15.74	0.29	67.0	8.73	19.0	2.55
	Summer										
	Fall	1.83	0.057	2.12	0.067	24.43	0.39	91.33	23.03	22.5	2.88

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft.-lbs.		REMOLDED SPEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	M	SD
5.2 Ap	Spring	1.25	0.015	1.54	0.057	22.73	4.08				
	Summer	1.42	0.02.1	1.78	0.017	24.98	0.60	67.0	10.37	21.0	5.92
	Fall	1.37	0.025	1.73	0.040	26.37	0.61	37.0	8.37	83.0	16.6
5.2 Aej	Spring	1.62	0.093	1.93	0.099	18.67	0.54	29.17	5.31	8.17	3.06
	Summer										
	Fall										
5.2 Btj	Spring	1.66	0.027	1.94	0.015	16.65	1.30	31.0	3.16	11.50	1.29
	Summer	1.57	0.091	1.83	0.080	16.61	1.67	51.0	1.73	15.33	0.58
	Fall	1.61	0.015	1.93	0.017	20.13	0.24	30.0	0.0	14.5	1.0
5.2 Ck	Spring	1.88	0.061	2.12	0.056	12.73	0.82	38.83	11.20	10.83	2.56
	Summer	1.68	0.081	1.87	0.072	11.16	1.29	44.75	8.06	9.5	1.29
	Fall	1.89	0.055	2.12	0.032	12.38	2.24	47.0	7.58	32.0	21.68
5.3 Ap	Spring	1.30	0.039	1.74	0.0458	29.26	1.03				
	Summer	1.25	0.0265	1.59	0.032	27.08	1.64	36.0	1.16	12.75	0.50
	Fall	1.38	0.049	1.76	0.055	27.84	0.28	25.25	2.36	9.0	1.16
5.3 Aegj	Spring	1.61	0.0929	1.93	0.061	19.40	2.92	30.0	1.14	7.0	0.82
	Summer	1.41	0.076	1.64	0.062	14.87	2.49				
	Fall										
5.3 Btgj	Spring	1.61	0.028	1.99	0.035	18.56	2.39	38.00	10.65	8.80	3.35
	Summer	1.56	0.042	1.85	0.031	18.69	1.59	71.0	10.25	23.0	4.47
	Fall	1.57	0.029	1.88	0.027	19.39	0.57	35.4	5.51	10.2	2.05
5.3 Ckgj	Spring	1.89	0.070	2.15	0.051	13.41	1.51	30.50	4.59	7.67	2.88
	Summer	1.90	0.055	2.12	0.052	10.95	0.53				
	Fall										

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft.-lbs.		REMOLDED SHEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	M	SD
10.1 Ap	Spring	1.28	0.0173								
	Summer										
	Fall	1.40	0.1234	1.72	0.075	22.85	5.55				
10.2 Ap	Spring										
	Summer										
	Fall	1.29	0.047	1.63	0.059	25.73	0.52				

SITE/HORIZON/ SEASON		DRY BULK DENSITY g/cm^3		WET BULK. DENSITY g/cm^3		MASS WETNESS %		INITIAL SHEAR STRENGTH ft.-lbs.		REMOLDED SHEAR STRENGTH ft.-lbs.	
		M	SD	M	SD	M	SD	M	SD	M	SD
13.1 Ap	Spring	1.53	0.021	1.83	0.017	19.83	1.30	19.0	2.45	4.8	0.45
	Summer	1.39	0.061	1.50	0.062	7.94	0.52	95.0	12.25	26.25	2.5
	Fall	1.31	0.015			16.55	0.62	34.75	1.26	15.0	0.0
13.1 Aegj	Spring	1.61	0.044	1.86	0.0436	15.70	0.47				
	Summer	1.60	0.006	1.73	0.006	8.64	0.60				
	Fall	1.46	0.049	1.68	0.025	7.94	0.52				
13.1 II Btgj	Spring	1.55	0.027	1.88	0.021	21.46	1.20	29.5	7.5	12.33	2.42
	Summer	1.67	0.025	1.97	0.027	17.80	0.37	53.75	4.78	20.0	4.08
	Fall	1.54	0.035	1.87	0.042			25.2	7.66	9.20	3.96
13.1 II Ckgj	Spring	1.67	0.030	1.98	0.027	18.79	0.56	36.33	5.41	7.67	2.18
	Summer	1.49	0.074	1.90	0.051	26.98	2.62	33.75	2.50	8.75	2.50
	Fall	1.58	0.131	1.92	0.100			35.25	4.71	10.75	0.96
13.2 Ap	Spring	1.40	0.029	1.69	0.015	13.93	0.17	23.83	2.93	7.17	1.72
	Summer	1.35	0.042	1.42	0.040	6.27	0.32	67.50	5.00	18.89	5.47
	Fall	1.37	0.020	1.54	0.021			34.75	2.36	12.50	1.73
13.2 Bm	Spring	1.40	0.028	1.84	0.020	18.06	0.79	25.0	2.91	6.2	0.84
	Summer	1.42	0.021	1.50	0.021	5.29	0.40	47.5	2.89	16.25	2.50
	Fall	1.41	0.020	1.58	0.025	11.63	0.31	26.5	1.73	10.25	1.89
13.2 Bg	Spring	1.55	0.040	1.89	0.036	21.39	1.03	34	4.18	9.4	0.54
	Summer	1.42	0.021	1.49	0.023	5.29	0.40	30.0	0.0	10.0	0.0
	Fall	1.49	0.006	1.67	0.006	23.35	0.36	54.5	6.40	18.5	1.29
13.3 Ap	Spring	1.55	0.020	1.82	0.036	17.20	0.72				
	Summer	1.47	0.017			12.60	0.25	35.0	0.0	8.0	1.41
	Fall	1.50	0.023	1.71	0.023	14.00	2.92	29.75	3.78	10.75	1.71
13.3 Aegj	Spring	1.48	0.090	1.75	0.061	20.80	0.28	17.0	1.58	3.4	0.89
	Summer	1.51	0.030	1.66	0.017	6.91	2.17	60.0	7.07	22.5	2.87
	Fall	1.62	0.072	1.96	0.015	20.20	6.96	24.4	6.11	9.4	1.67
13.3 II Btgj	Spring	1.61	0.010	1.94	0.010	20.66	0.21	29.6	5.68	8.5	2.92
	Summer	1.64	0.012	1.96	0.010	19.29	0.32	60.0	7.07	22.5	2.89
	Fall										
13.3 II Ckgj	Spring	1.67	0.006	2.02	0.006	20.58	0.37	52.50	5.26	10.25	1.26
	Summer	1.70	0.015	2.04	0.015	19.12	0.43	47.33	2.52	15.0	0.0
	Fall	1.68	0.012	2.02	0.010	20.33	0.22	32.0	3.08	12.2	2.17

SITE/ HORIZON	ATTERBURG LIMITS W_L	W_P	I_P	COMPACTION MAX. WET DEN. g/cm^3	MAX. DRY DEN. g/cm^3	O M C	C B R SWELLING DRY DEN. g/cm^3	M C %	SWELL	PVC SWELLING SWELL kg/m^2 PRESSURE		PARTICLE DENSITY g/cm^3	SHRINKAGE RATIO	LIMIT
1.1 Ap	42	21	21	1.97	1.63	20.5	1.57	19.6	2.89	10,121	M	2.59	1.74	18.42
Bg1	46	24	22	2.03	1.66	21.5	1.57	25.7	1.96	13,029	M	2.70	1.83	14.51
Ckg	38	19	19	2.09	1.84	16.8	1.67	18.0	3.04	9,418	M	2.67	1.79	15.79
1.2 Ap	36	20	16	1.97	1.62	21.5	1.56	23.5	2.02	11,155	M	2.57	1.51	10.09
Bg	39	20	19	2.06	1.71	20.1	1.82	19.9	1.02	4,684	NC	2.63	1.84	14.70
Ckg	34	18	16	2.15	1.85	16.2	1.68	20.7	1.22	8,813	M	2.66	1.75	16.57
3.1 Ap	50	29	21	1.93	1.55	24.2	1.47	26.1	1.64			2.54		
Bg1	44	19	25	1.99	1.62	25.0	1.48	27.5	0.67			2.59		
3.2 Ap	45	26	19	1.88	1.53	23.5	1.48	26.1	1.47			2.59		
Ckgj	34	17	17	2.16	1.87	15.0	1.82	17.6	0.27			2.81		
3.3 Ap	38	25	13	1.95	1.61	21.5	1.54	23.7	1.69			2.63		
Ckgj	33	16	17	2.17	1.89	15.0	1.75	19.3	0.40			2.78		
4.1 Ap	40	26	14	1.92	1.56	22.0	1.51	23.2	2.02			2.64		
Bg2	45	15	30	2.03	1.69	20.4	1.60	22.4	1.51			2.69		
Ckg	26	15	11	2.23	1.94	14.5	1.82	15.06	0.93					
4.2 Ap	35	23	12	1.99	1.63	20.7	1.57	22.2	2.07	5,813	NC	2.65	1.53	34.88
Btgj	44	21	23	2.03	1.66	21.8	1.57	24.2	0.89	12,283	M	2.69	1.85	19.49
Ckgj	17	9	8	2.29	2.10	8.8	1.96	9.8	0.60		NS	2.74	1.99	11.61
4.3 Ap	36	21	15	1.94	1.60	19.8	1.58	21.0	3.20	4,026	NC	2.47	1.57	22.40
Btgj	38	16	22	2.04	1.69	21.1	1.56	24.0	0.89	9,252	M	2.58	1.73	19.87
Ckgj	27	15	12	2.18	1.91	14.1	1.81	15.9	0.49	7,310	NC	2.62	1.94	11.77

SITE/ HORIZON		ATTERBURG LIMITS			COMPACTION			C B R SWELLING			P V C SWELLING		PARTICLE DENSITY	SHRINKAGE	
		W_L	W_P	Ip	MAX. WET DEN. g/cm^3	MAX. DRY DEN. g/cm^3	OMC	DRY DEN. g/cm^3	M C %	% SWELL	SWELL kg/m^2 PRESSURE		g/cm^3	RATIO	LIMIT %
5.1	Ap	47	31	16	1.82	1.45	25.5	1.38	29.1	3.24			2.55		
	Btjg1	30	17	13	2.12	1.81	17.3	1.71	18.6	0.84			2.64		
	Ckg	22	13	9	2.21	1.97	12.3	1.95	12.2	0.11			2.74		
5.2	Ap	31	20	11	2.00	1.69	18.3	1.63	19.4	1.89	3,591	NC	2.53	1.57	25.72
	Btj	24	15	9	2.16	1.93	12.0	1.92	12.8	0.56	3,162	NC	2.63	1.B2	15.48
	Ck	19	12	7	2.30	2.10	9.4	2.06	10.0	-0.07	2,186	NC	2.65	1.93	12.34
5.3	Ap	35	24	11	1.88	1.54	21.6	1.50	23.5	3.27	4,592	NC	2.47	1.47	25.94
	tgj	23	17	6	2.15	1.89	13.5	1.81	14.2	0.64	4,782	NC	2.52	1.67	21.79
	Ckgj	17	12	5									2.55	1.97	11.97
10.1	Ap	45	21	24	1.97	1.63	20.9	1.58	22.6	0.69			2.42		
	Bg	50	23	27	1.99	1.62	22.2	1.54	26.8	1.07					
	Ckgj	49	24	25	2.06	1.69	22.2	1.58	23.5	1.09					
10.2	Ap	52	34	18	1.87	1.45	28.9	1.37	33.6	1.29			2.61		
	Btgj	56	26	30	1.98	1.59	24.6	1.52	27.6	1.02					
	Ckgj	47	22	25	2.02	1.67	20.6	1.64	23.2	1.53					
13.1	Ap				1.99	1.71	15.7						2.58	1.65	20.08
II	Btgj	22	16	6	2.16	1.92	13.0	1.83	15.4	0.69			2.60	1.76	16.39
II	Ckgj	20	17	3	2.13	1.89	12.8	1.85	13.9	0.40			2.67	1.74	17.72
13.2	Bm				1.96	1.71	14.9						2.63		
	Ckg				1.94	1.65	18.1						2.69		
13.3	Ap				2.03	1.77	1.3.6						2.63	1.74	19.95
	Ae				1.96	1.72	14.2						2.63	1.63	16.59
	Btgj	24	17	7	2.11	1.83	15.2	1.80	15.4	1.16			2.64	1.77	16.59
	Ckgj	21	16	5	2.10	1.85	13.8	1.80	14.42	1.36			2.67	1.72	15.70

APPENDIX IV

MINERALOGY OF THE CLAY-SIZE FRACTION OF SELECTED SOILS

Appendix IV contains the clay-sized mineralogy of the most common soils found in the subwatersheds. The presence (P) or absence (A) of dolomite, calcite and feldspar is noted. An estimate (±5%) of the remaining minerals is given in per cent. Totals may not always be 100% due to rounding. The abbreviation used in the headings are as follows:

DOLO	- dolomite
CALC	- calcite
KAOL	- kaolinite
QUAR	- quartz
MICA	- mica p
IN10	- interstratifield 10-14 Å
VERM	- vermiculite
CALO	- chlorite p
IN14	- interstratifield 14-16 Å
MONT	- montmorillinite

Site	Horizon	Dolo	Calc	Feld	Kaol	Quar	Mica	In10	Verm	Chlo	In14	Mont
1 . 1	Ap	A	A	A	2	2	60	25	4	4	4	0
	Bg_1	A	A	A	2	4	59	19	9	3	3	1
	Bg_2	A	A	A	1	5	56	25	8	2	4	0
	Ckg	A	A	A	1	0	68	25	0	3	3	1
1.2	Bg	A	A	A	1	3	42	31	5	8	6	3
	Ckg	A	A	A	0	0	72	17	0	9	1	0
3.2	Ap	A	A	A	0	24	21	31	17	3	4	0
	Aegj	A	A	A	0	5	22	35	29	3	6	0
	$Btgj_1$	A	A	A	0	7	25	36	25	4	3	0
	$Btgj_2$	A	A	A	0	5	26	41	18	4	5	1
	Ckgj	A	A	P	1	6	39	34	16	3	2	0
3.3	Ap	A	A	A	0	19	23	31	16	5	6	0
	Ae	A	A	A	1	8	21	32	29	7	4	0
	Bt	A	A	A	2	8	36	30	17	4	3	0
	Ckgj	A	P	A	2	3	42	34	11	8	2	0

Site	Horizon	Dolo	Cale	Feld	Kaol	Quar	Mica	In10	Verm	Chlo	In14	Mont
4.1	Ap	A	A	A	0	4	50	26	6	6	6	3
	Bg_2	A	A	A	2	0	55	23	10	5	3	2
	Ckg	A	A	A	2	4	51	29	9	3	4	0
4.2	Btgj	A	A	A	3	6	39	26	12	3	6	4
	Ckgj	P	P	A	1	4	46	31	3	9	5	1
4 .3	Ap	A	A	A	0	6	24	36	23	3	7	1
	Aegj	A	A	A	1	5	31	28	22	2	6	5
	Btgj	A	P	A	0	2	36	38	9	7	5	3
	Ckgj	A	P	A	0	1	33	42	17	3	3	0
4 .4	Ap	A	A	A	1	1	34	35	12	3	10	5
	Ae_2	A	A	A	1	12	22	36	14	8	7	1
	Bt	A	A	A	2	2	46	32	6	7	6	1
	Ck	A	P	A	2	3	49	26	5	9	5	1
4.5	Ap	A	A	A	0	8	13	28	30	7	11	4
	Btgj	A	A	A	2	6	20	31	27	5	8	2
	Ckgj	P	P	A	1	7	38	35	12	6	3	0
4.6	Ap	A	A	A	1	3	53	26	8	4	4	1
	Ck	A	A	A	1	3	50	28	11	4	4	1

Site	Horizon	Dolo	.Calc	Feld	Kaol	Quar	Mica	In10	Verm	Chlo	In14	Mont
	Ap	A	A	A	1	4	22	36	15	8	10	4
5.1	Aejg	A	A	A	2	6	36	29	5	11	8	3
	Btjg	A	A	A	0	2	24	34	31	5	3	0
	Ap	A	A	A	l	5	11	47	26	3	5	2
5.2	Aej	A	A	A	1	4	23	44	20	3	4	1
	Btj	A	A	A	2	5	50	27	8	10	3	0
	Ck	A	P	A	2	4	42	32	7	6	5	2
	Ap	A	A	P	2	12	12	16	34	22	2	0
5 .3	Aegj	A	A	A	0	5	12	37	34	6	4	1
	Btgj	A	A	A	1	1	16	44	31	3	4	1
	Ckgj	P	P	A	1	4	40	35	10	7	2	0
	Ap	A	A	A	3	9	17	30	18	10	11	3
5 .4	Btgj1	A	A	A	3	6	16	25	21	5	24	2
	Btgj2	A	A	A	1	2	38	24	19	4	8	4
	Ckgj	A	P	A	1	3	44	34	0	13	4	1
	Ap	A	A	A	0	14	20	40	16	0	9	2
5.5	Ae	A	A	A	3	10	21	34	19	4	7	2
	II Ck	A	A	A	0	14	19	39	10	10	9	0
	Ap	A	A	A	0	9	17	40	9	13	10	3
	Ae	A	A	A	1	8	11	38	29	7	6	1
5.6	Bt	A	A	A	3	12	36	28	3	10	6	2
	Ck	A	A	A	2	2	68	14	3	9	2	0
	II Ck	A	A	A	0	7	43	36	5	6	4	0

Site	Horizon	Dolo	Calc	Feld	Kaol	Quar	Mica	In10	Verm	Chlo	In14	Mont
10.1	Ap	A	A	A	0	1	28	46	23	0	2	0
	Bg	A	A	A	1	0	45	36	12	2	5	0
	Ckg	A	P	A	1	2	45	37	9	3	4	0
10.2	Ap	A	A	A	2	8	28	44	12	2	4	0
	Aegj	A	A	A	0	4	40	38	9	4	6	0
	$Btgj_1$	A	A	A	2	8	43	38	7	2	1	0
	$Btgj_2$	A	A	A	1	1	59	25	10	2	2	0
	Ckgj	A	P	A	1	0	61	26	5	4	3	0
13.1	Ap	A	A	A	2	6	15	25	19	21	9	3
	Aegj	A	A	A	2	11	13	28	7	28	9	1
	II Btgj	A	A	A	3	5	45	25	0	14	6	2
	II Ckgj	A	A	A	2	10	41	22	3	15	5	3
13 .2	Ap	A	A	A	0	14	12	23	16	22	12	2
	Bm	A	A	A	0	7	16	28	25	7	13	4
	Bg	A	A	A	0	8	26	40	8	10	7	2
	Ckg	A	A	A	3	6	47	24	2	9	7	3
13.3	Ap	A	A	A	0	9	19	41	40	10	0	0
	$Aegj_2$	A	A	A	3	7	24	25	22	12	5	3
	II Btg	A	A	A	1	3	40	20	11	11	9	4
	II Ckg	A	A	A	1	0	48	23	0	19	5	4
13.4	Ap	A	A	A	0	14	8	39	28	5	4	1
	Aegj	A	A	A	2	17	13	29	29	7	3	0
	Btgj	A	A	A	0	1	17	39	38	1	3	1
	Ckg	A	A	A	1	2	48	34	8	3	3	1