New York State College of Agriculture Cornell Miscellaneous Bulletin 68

Soil Survey of Cornell University Property and Adjacent Areas

by Marlin G. Cline and Arthur L. Bloom

TABLE OF CONTENTS

Soil correlation by the Soil Conservation Service, United States Department of Agriculture.

Soil Survey of Cornell University Property and Adjacent Areas

The area includes those parts of Cornell Plantations and experimental fields within three miles east of the Cornell University Campus. It extends on the north to Hanshaw Road, on the east to Monkey Run and Turkey Hill Roads, on the south to Ellis Hollow Road, and on the west to East Ithaca Station, the Cornell Campus, and the University Golf Course. The Savage farm on Triphammer Road has been included as an inset on Map A1. Areas of privately owned land intermingled with Cornell properties are included.

The soil maps are at a scale of about 6.7 inches to 1 mile, which is larger than the scale used for detailed mapping. The large scale was used to permit delineation of areas as small as ½ acre for accuracy of soil identification on experimental areas. A standard soil survey of Tompkins County at 4 inches to 1 mile has been published (United States Department of Agriculture, 1965) and has used a generalized version of the maps presented here. Because of the larger scale of the maps in this bulletin, it has been possible to present not only much more detailed maps, but also much greater categorical detail of the legend than is possible in the survey of Tompkins County.

GEOLOGY AND SOILS

Bedrock Geology

The entire area is underlain by the Enfield formation of Upper Devonian age. The formation consists of dark bluish-gray shale and thin-bedded sandstone, with sandstone beds becoming progressively more abundant in the upper part of the section. The rocks dip gently southward, so that the uppermost sandstones are exposed on the steep upper slopes of Turkey Hill east of Turkey Hill Road, and at lower altitudes immediately south of the mapped area, south of Ellis Hollow Road. Several quarries are opened in the sandstone beds of the formation along the north slope of Hungerford Hill, south of Ellis Hollow Road.

Bedrock is not the parent material of any soils in the area. Exposures of rock are limited to the bed of Fall Creek from the rose gardens downstream to Forest Home, the bed of Cascadilla Creek downstream from the fish hatchery, and minor outcrops in gullies and ditches. However, the Enfield and similar formations have contributed heavily to the glacial drift that blankets most of the area. Typically, 70 to 90 percent of the pebbles, cobbles, and boulders in the drift are derived from the Enfield formation and similar local rocks. The percentage is probably slightly lower in the sand-, silt-, and clay-size fractions, because the finer sediment generally was transported farther by ice of meltwater, and is thereby enriched in limestone and other rock types from source areas north of Ithaca. The Enfield formation is weakly calcareous to non-calcareous. It produces strongly acid soils in the upland regions south of Ithaca where the glacial drift is thin or discontinuous. On weathering, the formation produces thin sandstone slabs and channers in a gray or brown silty clay matrix.

Glacial Geology

At the time when the retreating ice front of the Wisconsin glaciation stood at the Valley Heads moraines south and east of Ithaca, the entire Cornell University property was glaciated. An ice tongue extended southeastward up Sixmile Creek Valley to Slaterville Springs, and another extended northeastward up Fall Creek valley past McLean. Cascadilla Creek valley (Ellis Hollow) was presumably ice-filled, although Snyder Hill by then may have emerged through the ice. The ice tongues were actually little more than lateral protrusions from the thick ice that filled the Cayuga trough. This episode in the glacial history of the area is generally correlated with the late Cary substage of the Wisconsin glaciation in the midwestern glacial sequence. A minimum age of 12,000 years can be assigned from the radiocarbon age of wood overlying Valley Heads outwash in Erie Co., New York (Merritt and Muller, 1959, p. 476). Deglaciation must have been rapid, and by 11,400 years ago the ice front was north of King Ferry. Wood in a kettle north of King Ferry, associated with mastodon remains, dated 11,410 ± 410 years old and could not have been deposited until that locality was ice free (Merritt and Muller, 1959, p. 477).

The parent materials of the area were distributed during each of the following phases of the last glaciation, when (1) ice advanced up the Cayuga trough toward the area, (2) ice overrode the area at the maximum of glaciation, and (3) the ice front retreated and proglacial lakes developed in the valleys. The key regional landscape element is the deep trough now occupied by Cayuga Lake, which permitted ice to reach the latitude of Ithaca before the valleys of Fall Creek, Cascadilla Creek and Sixmile Creek were glaciated, and which maintained an active ice front over Ithaca until after the three lesser valleys were deglaciated.

The high banks along Fall Creek north of Varna (figure 1) show the glacial stratigraphy. The lower half of the undercut bank over 100 feet in height exposes poorly sorted, crudely stratified sand and gravel, contorted by ice push. About 90 percent of the pebbles in the gravel are sandstone and shale of local derivation, and about 10 percent are limestone and crystalline erratics from the north. The sand, silt and clay matrix of the gravel is strongly calcareous. This stratified sand and gravel records the damming of lower Fall Creek by ice spreading eastward out of the Cayuga trough, while the headwaters of the creek were still ice-free.

Overlying the sand and gravel is about 40 feet of compact, loam till that records the advance of ice up Fall Creek valley. Only about 70 percent of the till pebbles are of local origin, and most of the remaining 30 percent are limestone or dolomite. The tough, blue-gray loam matrix of the till is strongly calcareous. The upper 10 to 20 feet of the till is oxidized, as evidenced by brown colors. The topmost 4 to 6 feet of till is leached of carbonates, and there are gravel layers and silt lenses in the upper 5 to 10 feet that suggest water reworking.

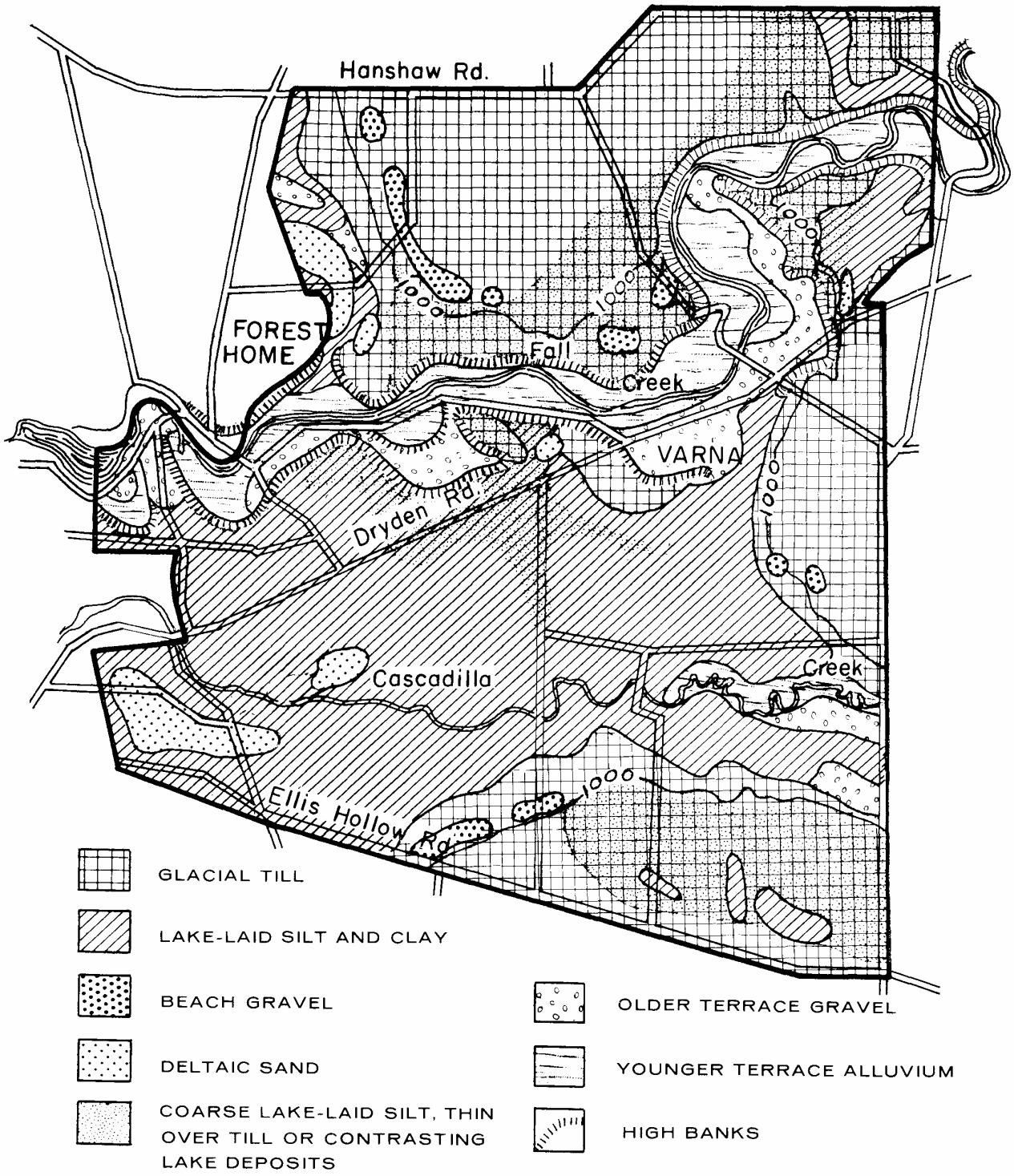


Figure 1. Parent materials of soils of the area.

The till in the high banks is capped by up to 10 feet of water-laid silt, fine sand, and minor amounts of clay. The excellent sorting and horizontal stratification of this layer indicate deposition in a shallow lake with currents sufficient to sweep away most of the clay in suspension. Figure 1 shows the silt to be widespread on the north side of Fall Creek on the Warren, Ketola and Fox farms, and also north of Ellis Hollow Road between Town Line Road and Turkey Hill Road. Over most of the area, the silt is much thinner than in the banks of Fall Creek, generally not exceeding 15 to 20 inches in thickness. The silt extends up to the 1060 foot contour line, and was deposited in a shallow proglacial lake that covered Fall Creek valley east of Forest Home and Ellis Hollow and overflowed south through the steep-walled valley at the head of Ellis Hollow. This lake persisted as long as the retreating ice front pressed against the west slope of Hungerford Hill above the sheep farm, for there was no lower outlet available into Willseyville Creek to the south. Fairchild (1934, p. 249–250) named this Cascadilla Lake, but the area submerged also includes the southern part of what he called Freeville-Dryden Lake.

When the ice front had melted back from the west slope of Hungerford Hill, the final stage of late-glacial deposition began. A large lake named Lake Ithaca (Fairchild, 1934, p. 252–257; Engeln, 1961, p. 93–96) formed from the merging of smaller proglacial lakes in each of the tributary valleys around the south end of the Cayuga trough. The overflow of Lake Ithaca was 2 miles south of Brooktondale at an altitude of slightly over 980 feet, into the head of Willseyville Creek. Lake Ithaca was larger, deeper, and less stirred by currents than the earlier, higher Cascadilla Lake, and clay and silt rather than coarse silt and sand are the dominant sediment types below the shoreline level. All of the lake-laid silt and clay below the 1000-foot contour on figure 1 was deposited in Lake Ithaca. Two patches of similar clayey material on the Fox farm and in the pine plantations northeast of Varna were deposited with the silt of Freeville-Dryden Lake, and two silt-filled basins in the southeastern corner of the mapped area form locally thicker patches of Cascadilla Lake silt.

Two deposits of Lake Ithaca deserve special mention for their soil-forming properties. First, beach gravel eroded from the till along the Lake Ithaca shoreline forms thin gravel veneers over till just below the 1000-foot contour south of Cascadilla Creek and just above the 1000-foot contour on the Warren farm (figure 1). Although these gravel beaches are 10 to 20 feet above the present altitude of the floor of the overflow channel, they may have formed before the channel was eroded to its final depth.

The second unusual deposit of Lake Ithaca is the thin sheet of coarse silt and fine sand that overlies contrasting clayey lake deposits from Caldwell Field eastward in an irregular arc through McGowan Woods (figure 1) and across the experimental plots north of the Game Farm. When the water surface lowered about 80 feet from the former Freeville-Dryden and Cascadilla Lakes to the level of Lake Ithaca, upper Fall Creek began dissecting the newly exposed silty plain of Freeville-Dryden Lake, and washed the coarse silt and sand into the shallow northeast arm of Lake Ithaca.

Lake Ithaca persisted long enough at the 980-foot level and later at the 940-foot level to deeply mantle all gentle slopes below these altitudes with silt and clay. Over most of the area of figure 1 the Lake Ithaca sediment is gray or gray-brown, reflecting a dominantly local source for the rock fragments. On the Savage farm on North Triphammer Road the Lake Ithaca sediments are slightly redder, reflecting a larger contribution of red-colored sediments carried from the north by the main lobe of ice in the Cayuga trough. The Lake Ithaca sediments are moderately to strongly calcareous.

The mapped area includes three small deltas, one at the western edge of the Warren farm, one a very small spot in the southern part of the Cornell Orchard, and the third extending from the New York Artificial Breeders Cooperative through the vegetable crops gardens at East Ithaca (figure 1). The deltaic sand and fine gravel overlie lake-laid silt and clay, and accumulated where streams discharged into Lake Ithaca.

Postglacial Erosion and Soil Development

As the level of Lake Ithaca fell in postglacial time, progressively lower slopes emerged and the soil-forming processes began. The till on the higher ground north of Fall Creek, on the western slope of Turkey Hill and south of Cascadilla Creek already had been exposed for some time. The soils developed in this till have well expressed fragipans and typically are somewhat poorly drained. The catena of soils that includes the Langford, Erie, and Ellery series is mapped where till extends to the surface.

The thin deposits of coarse silt from Freeville-Dryden Lake and Cascadilla Lake above the Lake Ithaca shore were the next units to be exposed to soil formation. Recognizable remnants of these deposits range in thickness from as little as 12 inches to as much as 30 inches, but they are mainly of the order of 15 to 20 inches thick. The moderately well drained Canaseraga and the somewhat poorly drained Dalton series have been mapped where these mantles of silty or very fine sandy materials are thick enough over the till to be recognized as distinct deposits but not thick enough that the entire solum of the soil is in the mantle. In most places the thickness of the deposit is of the order of 15 inches, which is the minimum required for recognition of these two series. Consequently, these soils have been named 'thin mantle phases" of Canaseraga and Dalton soil types to indicate that they are intergrades to the Langford and Erie soils, which are in glacial till without the mantle. In the soil survey of Tompkins County (United States Department of Agriculture, 1965) the Canaseraga and Dalton series are not recognized and these areas are shown as Langford and Erie soils and are described as inclusions.

The high-level clayey deposits of Freeville-Dryden Lake on the Fox farm and in the pine plantations west of Monkey Run Road and south of Fall Creek have developed fine textured soils that have been included in the Hudson and Rhinebeck series. These are mentioned specifically because they lie at distinctly higher elevations than other areas of lake-laid silt and clay and are slightly older than the deposits of Lake Ithaca.

The beach gravel and deltas of Lake Ithaca were the next units to begin developing soils. The soil on the beach gravel is essentially a Chenango soil, but it overlies glacial till at shallower depth than is typical of the central concept of the series. These soils have been indicated as "Chenango gravelly loam over till." The adjacent lower areas are wet and have many seep spots. These areas have been mapped either as a complex of the poorly drained Ellery and somewhat poorly drained Erie soils or, where better drained, as a gravelly loam type of the Langford series. The Arkport series is mapped on the sandy deltas.

As Lake Ithaca continued to fall, the coarse silt and very fine sand veneer of the Caldwell Field-McGowan Woods area was exposed. This deposit is mainly 30 to 40 inches thick over more clayey sediments typical of the Collamer series. The deposit not only is distinctly coarser, but also is more acid than the materials associated with the Collamer soils.

The soils that have formed in it have been included in the Williamson series, which is characterized by a color B overlying a silty or very fine sandy fragipan. Though these soils are within the range of the Williamson series, they are influenced by more clayey material, like that of Collamer soils, in the lower part of the solum in most areas. Consequently, the fragipan is less strongly expressed than is typical of the central concept of Williamson soils. For this reason, these soils have been identified as "weak fragipan phases" of the Williamson soils. They are intergrades to the Collamer series and are inclusions in map units of the Collamer series in the Tompkins County Soil Survey (United States Department of Agriculture, 1965).

Where the coarse silt veneer thins southward and merges with the normal Lake Ithaca silt and clay across Caldwell Field, the Cornell Orchards, the Poultry Range, and the north edge of the Game Farm, the soils contain more clay but are still dominated by silt. The soils on these areas are identified as members of the catena whose well drained member is Dunkirk. Most of these areas are not so well drained as Dunkirk, however, and Collamer, the moderately well drained member of the catena, is the most extensive soil. Niagara, the somewhat poorly drained member, is a major associate. The poorly drained Canandaigua soils occupy the lowest-lying areas.

The soils of the western part of the Cornell Orchards, those south of Cascadilla Creek, and those on the Reed farm are higher in clay, mainly having silty clay or heavy silty clay loam B and C horizons. Most of these areas are somewhat poorly drained and are included in the Rhinebeck series. On the distinctly convex land forms of these areas, the Hudson series has been mapped, and in the poorly drained depressions and along drainageways, the soil is mainly Madalin. Small areas of soil in fine textured material at the western edge of the Warren farm are also included in these series.

The Savage farm, which is not shown on figure 1, lies well below the beach of Lake Ithaca and is almost entirely on silt and clay typical of those mapped in the Rhinebeck and Hudson soil series. The soils in this area are slightly redder than those in similar materials along Cascadilla Creek and reflect the contribution of red-colored sediments carried by the main lobe of ice in the Cayuga trough.

Fall Creek has had a complex postglacial history. As the succession of proglacial lakes in the Cayuga trough gradually fell to the level of present Cayuga Lake, Fall Creek has energetically re-excavated its interglacial valley. The thin cap of silt from Freeville-Dryden Lake was cut through while Lake Ithaca still drained through Willseyville Creek. Subsequently, Fall Creek established its postglacial course down the side of the Cayuga trough, soon to become superposed across buried rock spurs to give the succession of gorges and falls along the north edge of the campus. North of Varna, Fall Creek has not yet exposed its former rock floor, and flows over till capped by a thin gravel floodplain. The terraces and abandoned meanders of Fall Creek are cut into the stratified sand and gravel that form the bottom half of the valley fill. The gravel is non-calcareous, and when the calcareous fines were washed out by the stream, the gravel terraces developed acid soils.

Four levels of terraces and abandoned meanders apparently record temporary halts in the postglacial downcutting of Fall Creek valley. The highest level, typified by the eastern half of the plant breeding area north of Varna and the terrace that lies south of and at a higher elevation than the rose gardens, is clearly older than the other terraces and is mapped as "Older Terrace Gravel" in figure 1. On these highest terraces a well expressed 'Sol Brun Acide" profile has developed in gravelly material, and on these areas, the Chenango series has been mapped. Though these terraces are the highest in the valley, they lie well below the beaches of Lake Ithaca and must postdate the time at which the ice had receded far enough northward to permit the level of Lake Ithaca to fall at least as low as 900 feet above sea level.

The second series of terraces is only a few feet or a few tens of feet lower than the Chenango terraces described, but the soils on them are clearly much younger. The material is mainly gravelly or very gravelly and appears to be similar lithologically to that of the higher-lying Chenango terraces. The soils, however, have only faintly expressed color profiles and, on this basis, are judged to be distinctly younger than soils of the Chenango terrace. They flood occasionally, but they are distinctly higher than the current first bottomlands. Though higher and certainly somewhat older than the bottomland, these intermediate terraces have little evidence of greater expression of a genetic soil profile. Consequently, these soils have been included in the Tioga series as "high bottom phases." These areas are typical of the rose gardens and the areas used by plant breeding both east and west of Freese Road (figure 1). The soils are strongly acid, and though pH may be higher deep in the substratum pH does not increase to values of 6 or above within the 3-foot section in most places.

The next lower terraces are subject to more frequent flooding, though they lie only a few feet lower than the "high bottoms." These soils are relatively free of gravel in the topmost two or three feet and are in recent alluvium. They are typically acid in the topmost several inches, but pH increases with depth and is commonly greater than 6 at a depth of 36 inches. The well drained soils have been included in the Tioga series; the moderately well drained soils, in the Middlebury series. Though these areas flood relatively frequently, the rate of deposition is apparently slow, and distinct A1 and very weak color B horizons have developed. The degree of genetic profile expression is comparable to that on the adjacent higher Tioga terraces.

Adjacent to the present course of the stream are areas where flood waters very frequently cut and recut new channels and deposit much very coarse material. These areas are mainly covered with vegetation. The soil on these areas has little genetic profile and is very heterogeneous. It is mapped as Alluvial land, a unit in which soils are unclassified.

SOILS

Though the area mapped is small, it contains a large proportion of the soils found in Tompkins County. Seventy-one different kinds of map units have been recognized. Twenty-five soil series and seven units of unclassified soil are represented within an area of approximately 5 square miles.

In the following pages each kind of soil area is described in approximate alphabetical order of letter map symbols, which designate soil series or land types on the map. The symbols have been chosen to be suggestive of the soil name, each symbol starting with the initial letter of the soil series or land-type. Where two or more soils have the same initial letter, lower case letters have been used to differentiate among them. Thus D stands for Dalton; Da, for Darien; and Du for Dunkirk series. A second capital letter is used to indicate the slope phases of classified soils, according to the following system:

A—Nearly level phases, 0 to 2 or 3 percent gradient;

B—Undulating or gently sloping phases, 2 or 3 to 6 or 8 percent gradient;

C—Rolling or sloping phases, 6 or 8 to 12 or 15 percent gradient;

D—Hilly or moderately steep phases, 12 or 15 to 20 or 35 percent gradient;

E—Steep and very steep phases, steeper than 20 or 35 percent gradient.

The narrower limits and lower gradients indicated for a given phase and symbol apply to very erodible soils in lake sediments; the wider limits and higher gradients apply to soils in permeable gravel deposits and in glacial till. In each case the slope range of the phase is shown in the soil name. In cases where both an uneroded and an eroded phase of the same slope phase have been mapped, the lower case letter "e" is added to the symbol of the eroded phase. Thus, CoB stands for Collamer silt loam, 2–6 percent slopes; CoBe for Collamer silt loam, 2–6 percent slopes, eroded.

No attempt is made here to provide a detailed description of each kind of soil. The descriptions are given in general terms, and emphasis is placed on the variations that may be found among areas of each given kind of map unit in different parts of the area. For detailed soil descriptions and special interpretations, the reader should refer to the Soil Survey of Tompkins County (United States Department of Agriculture, 1965). For definitions of special terms used in the text to describe soil properties and conditions, the reader should refer to the Soil Survey Manual (Soil Survey Staff, 1951).

Unclassified Soil of the Flood Plains

Under this heading is one map unit of unclassified soil in very young alluvium.

A — Alluvial land

Alluvial land consists of very young soils in recent alluvial deposits. Gravel, sand, and some fine material are deposited on these areas each time the stream floods. The areas lie only a few feet higher than the stream channel and are cut and recut by the stream during periods of high water. Some areas are stony or gravelly; others are free of coarse fragments. Small areas are barren of vegetation, but most are vegetated with bushes, small trees, and herbaceous annuals. Small areas of Tioga soils are included where the stream has cut new channels that separate them from the main flood plain. Most of the soil has little or no genetic profile other than a very small accumulation of organic matter in the surface layer.

Arkport Series

The Arkport series consists of well drained sandy soils. In this area, Arkport soils have developed in sandy material deposited where streams once entered the still water of an ancient high-level lake in the Cayuga Valley. The upper part of the soil to a depth ranging from 20 to 36 inches has been leached and has been weathered slightly, leaving a thin yellowish brown coating of iron and organic matter on the sand grains. This part below the plowed layer is called a color B or cambic horizon. It is very strongly acid when unlimed, is generally low in plant nutrients, and has the moderate available moisture capacity typical of fine sandy loam material. Below the color B and extending to a depth ranging from 4 to 8 feet is a zone within which small amounts of silicate clay have been segregated in dark brown bands ⅛ to 1 inch thick and 4 to 18 inches apart. These coherent bands retard downward movement of water and contribute to higher water-supplying capacity than is typical of the dominant loamy fine sand or fine sand texture of the zone. The zone as a whole is called a banded B horizon. Acidity decreases with depth within the zone. Beneath the banded B are layers of sand of varying fineness, locally with thin lenses of silt. The deep substratum is weakly calcareous. The sandy deposits of Arkport soils probably overlie lake-laid silt and clay in most places, and near the margins of the sandy deltas, Arkport units include areas where sands are only 3 feet thick over silt or clay. All of the Arkport soils are exceptionally erodible.

The Arkport soils have been mapped in three principal areas. One, on the western side of the Warren farm adjacent to the golf course, is dominated by fine and medium sands. A small area has been mapped in the southern part of the Cornell Orchard. Here very fine sands predominate, and the type would more appropriately be designated as a very fine sandy loam. This is the most erodible of the Arkport areas mapped. A third area extends from the New York Artificial Breeders Cooperative barns through East Lawn Cemetary, and includes the Vegetable Crops gardens at East Ithaca. In this area, texture ranges from fine sandy loam to very fine sandy loam within short distances. Two smaller areas have been mapped, one east and the other west of Varna.

AkB — Arkport fine sandy loam, 2–6 percent slopes

The topography of this unit consists of small knolls and slight depressions. The knolls have had slight to moderate erosion, and the eroded material has been deposited in the intervening depressions. A very complex soil pattern has resulted. The surface soil on the knolls is lighter colored than that in the depressions, and the knolls are more droughty than the depressions. The amount of erosion that has occurred is small and would be of little significance in farm operations, but it is important for experimental work.

That part of the Vegetable Crops gardens north of the road at East Ithaca originally had undulating topography, but the area has been levelled. In this area the entire topmost 2 feet has been moved from some places and deposited in others. The slope gradient at the present time is slightly less than 1 percent. Obviously, the profile described for the Arkport series is not typical of all of this levelled area; much of the soil is man-made.

AkC — Arkport fine sandy loam, 6–12 percent slopes, eroded

These rolling areas occur at East Ithaca, on the Warren farm, in the Cornell Orchard, and west of Varna. Wherever these soils have been cultivated, there has been significant erosion on the slopes, and eroded material has accumulated in the associated depressions. On the knolls, most of the original surface soil has been lost; in a few places as much as 20 inches of soil appears to have been removed. In these eroded spots a new surface soil lower in organic matter and lighter in color than the original has developed under cultivation. The most severely eroded spot is probably that in the Cornell Orchard, where the very fine sandy loam texture contributes to very high erodibility. The surface of unvegetated areas commonly forms a crust after hard rains.

AkE — Arkport soils, 20–35 percent slopes

This unit has been mapped on the short steep slope north and west of the Vegetable Crops gardens. The area is in pasture;

at the present time it has a surface soil moderately high in organic matter. The soil is thinner on this steep slope than on less steeply sloping areas of the series.

Braceville Series

These are moderately well to somewhat poorly drained soils in gravelly deposits related to those in which the Chenango soils have formed. In such rapidly permeable material, some slowly permeable layer or horizon must be present or the areas would not be wet. A slowly permeable fragipan has formed where layers more silty than normal occur within 4 feet of the surface, and slowly permeable lake deposits underlie the gravel in most places.

The plowed layer is grayish-brown or dark grayish-brown gravelly loam. From 8 to 12 or 15 inches is a yellowish-brown gravelly loam color B which is distinctly mottled with grayish-brown in most places. From 12 or 15 to 20 or 24 inches is grayish-brown or light grayish-brown gravelly loam, which shows the effects of periodic saturation by having distinct mottles of yellowish-brown. To the bottom of this horizon, the soil is friable and permeable. From 20 or 24 inches to depths ranging from 3 feet to as much as 4 feet is a gravelly loam or gravelly silt loam structureless fragipan. This horizon is firm and slowly permeable. The thickness of the fragipan and its position in the profile vary greatly from area to area, depending upon depth and thickness of layers fine enough to permit fragipan development. Gravel and sand with thick to thin layers of silt or poorly sorted gravelly loam or gravelly silt loam material lie below the fragipan. Most of these layers are less firm and more rapidly permeable than the overlying fragipan, but slowly permeable lake silt and clay or glacial till occur at greater depth. The upper part of the solum and the fragipan are normally strongly or medium acid.

BA — Braceville gravelly loam, 0–3 percent slopes

The total area mapped is small. Two small areas lie adjacent to Dryden road northeast of Varna. On these two areas the wetness is apparently associated with seepage from the adjacent uplands, and it is probable that the underlying slowly permeable material in this case is glacial till. Two small areas have been mapped at the northern end of the Turkey Farm south of Cascadilla Creek. Here a deep excavation showed that the gravel deposit is 4 to 5 feet thick over lake clay and silt. The largest single area is on the western edge of the Warren farm. It appears to represent the margin of an ancient drainage channel that was cut after recession of the glacial lake that lay in Cayuga basin. To the depth that could be investigated the material was very poorly sorted. It is presumed to be underlain by lake sediments.

Canandaigua Series

These are poorly to very poorly drained soils in silty lake deposits like those of the Dunkirk, Collamer, and Niagara soils. The plowed layer is very dark gray or very dark grayish-brown silt loam. Its darkness makes the areas conspicuous in plowed fields. This is underlain by silt loam or light silty clay loam in coarse prisms composed of weakly expressed medium blocks. The surfaces of the prisms and of the blocks are gray or grayish-brown with few mottles, indicating strong reducing conditions along cleavage planes for long periods. The interiors of the blocks are brown and have many prominent or distinct mottles. This horizon extends to a depth ranging from 24 to 40 inches in various parts of the area and is underlain by calcareous stratified silt and very fine sand intermingled with thin layers of clay. In the second horizon, strata of very fine sandy loam material alternate with layers of silt in some places, giving the whole a platy structure. The exact character of the soil from spot to spot is related to the layering of the lake deposits in which the soil has developed. In most areas the entire soil is neutral or only slightly acid.

CA — Canandaigua silt loam, 0–2 percent slopes

This is the only unit of the Canandaigua series mapped in the area. It occupies the lowest-lying areas of lake-laid material, mainly along poorly defined drainageways. Areas north of the Game Farm headquarters are most nearly typical of the central concept of the series. Here, however, material eroded from higher-lying soils in lake silt has been deposited on the surface, and the dark surface soil is typically 10 or 12 inches thick. Locally in the vicinity of the Game Farm, the soil is a very fine sandy loam, and near the western end of this area, one spot of silty clay is included. An area at the northern end of the Turkey Farm is extremely variable from spot to spot. A thin gravel deposit ranging from a few inches to as much as 15 inches thick overlies the silt at many spots in this area. Gravel symbols have been used on the map to indicate these spots. Between the gravelly spots the surface soil is typically not so dark and apparently not so high in organic matter as on most areas of Canandaigua soil.

Three areas south of the Turkey Farm have stratified silt and very fine sand interspersed with thin strata of clay and occupy shallow depressions above the level of the beach of the major glacial lake of the Cayuga basin, but below that of a local lake that existed when Cayuga ice extended into the Fall and Cascadilla Creek basins. Except near the margins of these areas, glacial till was not encountered within a $3\frac{1}{2}$ foot section, but it is probable that the silt deposits are relatively thinner over glacial till than in most of the other areas mapped.

CmA — Canandaigua and Madalin mucky silt loams, 0–1 percent slopes

This unit has been mapped on the western part of the Warren farm, in the southeastern corner of the Tailby farm, and in an area adjacent to Cascadilla Creek west of the Turkey Farm. It represents the wettest areas of lake-laid silts and clays. The surface soil contains so much organic matter it approaches the consistence of a muck. Before disturbance by man 4 to 6 inches of muck probably lay on the surface of mineral soil. The name indicates that some areas are predominently silty and would be classified as Canandaigua, others are clayey and would be classified as Madalin and still others contain the two soils so intimately intermingled they could not be separated on the map.

The area on the Warren farm lies in an underfit drainage channel that extends northwestward from a point just west of the farm buildings. This area is extremely variable in texture from spot to spot and is dominated by a complex of Madalin and Canandaigua soils. Locally wet soils in gravelly deposits occur in areas too small to be delineated. It is probably that the deposit of silt and clay is not thick over glacial till, though till was not encountered within a depth of 3 feet except on the margins of the area.

The area east of Varna is on the high-level terrace on which Chenango soils are found. It occupies a narrow strip between the Chenango soils and the upland and is kept wet by water from small streams from the adjacent upland. The parent material is very silty and the surface soil in spots approaches a muck. Except for more strongly expressed structural development, the soil in this area is similar to a very poorly drained soil in recent alluvium.

The area south of Cascadilla Creek is the largest of the three. It occupies a low flat area that is kept wet by water from a tributary of Cascadilla Creek. The material is predominantly silt, and the soil is Canandaigua in most places. In spots the surface soil is a thin muck.

Canaseraga Series

The Canaseraga soils have formed in two contrasting materials, one upon the other. The topmost 15 to 30 inches is in coarse silt and very fine sand similar to the material from which the Williamson soils have formed. It is significant that this silty deposit lies below the elevation of the high-level local lakes that were empounded when ice blocked drainage both to the south and to the north in the Cayuga valley. Below a depth ranging from 15 to 30 inches, the soil is in glacial till similar to that of the Langford soils. The series may be characterized as a Langford-like soil with the topmost 15 to 30 inches in poorly graded silt and very fine sand.

The plowed layer from 0 to 8 inches is dark grayish-brown silt loam or channery silt loam; coarse fragments are less numerous than in Langford surface soils. From 8 to 15 inches is a yellowish-brown coarse silt loam or very fine sandy loam color B, commonly with less rock fragments than are present in the surface layer. The material is very friable and very strongly acid. From 15 to 20 inches is light yellowish-brown silt loam or very fine sandy loam, common distinct mottles indicating its periodic wetness. This horizon is essentially free of coarse fragments where the silt deposit is thickest; it is as channery as the glacial till where the silt mantle is thinnest. It is friable or very friable and is very strongly to strongly acid. Below 20 inches is very firm olive brown channery loam or channery light clay loam in very coarse prisms. This is a fragipan. It is normally medium acid in the upper part, but pH increases with depth. This pan extends to a depth of 4 or 5 feet and merges very gradually with the underlying firm glacial till. The till is calcareous at a depth ranging from 4 to 8 feet. The part of the profile below 20 inches is essentially similar to that of the Langford soils at similar depths.

This series has been mapped where the very fine sand or coarse silt layers can be distinguished consistently. Areas where the silty surface mantle is distinguishable locally but is not consistently recognizable within mappable areas have been included in the Langford soils. The thickness of the silt mantle in most areas covered in this report approaches the thinnest limit of the range of the Canaseraga series, and the units have been designated as "thin-mantle (phases)" to emphasize this fact. Where the silt mantle is thickest, stone fragments are conspicuously less numerous in the upper layers. Significantly, stone fragments are commonly more abundant in the plowed layer than below it, suggesting that they may have been moved upward through a stone-free material by frost action.

The soil occupies low convex knolls comparable to those occupied by the Langford soils but includes areas having low slope gradients and slight convexity on which somewhat poorly drained soils would be expected if the silt mantle were absent.

CaB — Canaseraga channery silt loam, thin mantle, 3–8 percent slopes

This is the only phase of the Canaseraga soils recognized in the mapped area. A very few areas could have been delineated on slopes 8 to 15 percent in gradient, but these areas are so small that they have been included in the Langford mapping units. The phase is confined to the areas shown to have a silty mantle in figure 1.

On the Warren, Behavior, Ketola, and Fox farms north of Fall Creek the phase occurs principally as small knolls within more extensive areas of the somewhat poorly drained Dalton soils, which are wetter soils in similar material. The largest areas are adjacent to the escarpment cut by Fall Creek. On most of these areas the thickness of the silt mantle is about 15 or 18 inches, and the surface horizon is nearly as channery as that of the Langford soils. Locally, the thickness of the silt mantle is as great as 30 or 40 inches and the upper part of the fragipan is in the silty mantle. In these places, the soil approaches a phase of Williamson.

Only one area has been mapped between Fall Creek and Cascadilla Creek, that on the upland adjacent to the escarpment south and east of the rose garden. This is an unusual area of low knolls separated by slight depressions; on the knolls the silt mantle is very thin, but in the slight depressions it is as much as 36 inches thick. This is a surprising location at which to find glacial till so near the surface, as adjacent areas have thick deposits of lake sediments.

Larger individual areas have been mapped south of the glacial lake beach in the southeastern corner of the area. Here the soils typically occupy subdued local relief where wetter soils might be expected. The relief increases eastward within this general region, and on the Turkey Farm the topography is that which one might expect of Langford soils. Generally throughout this region the silt mantle is 15 to 20 inches thick.

Chenango Series

The Chenango series includes well drained medium textured soils developed on gravelly glacial outwash or on old postglacial alluvium of similar character. The 8-inch plowed layer is characteristically a dark grayish-brown or very dark grayish-brown gravelly loam. It is underlain by a yellowish-brown gravelly loam color B that is very friable, permeable, and well aerated. From 36 to more than 50 inches, the colors gradually fade with depth. The color B rests on stratified gravel and sand leached of carbonates. The entire solum is strongly or very strongly acid. Typically, there is a slight concentration of silt and clay at the contact of the solum with the gravel. It is unlikely that all of the fine material in the upper part of the soil can be attributed to weathering of a gravel deposit like that of the substratum. Some contribution of wind- or water-deposited silty material on the surface is probable.

The Chenango series has also been used for soils in deposits of gravel relatively thinner than normal over glacial till where remnants of the beach of the glacial lake remain. These areas have Chenango-like profiles to 3 or 4 feet, but the Chenango soil is underlain by glacial till at a depth much less than that expected on the terraces.

CgA — Chenango gravelly loam, 0–3 percent slopes

This nearly level phase occupies the flattest parts of the terraces. The soil profile is like that described for the series.

The largest areas are on the Tailby farm north of Varna, on the high terrace adjacent to the rose gardens, on the terrace south of Fall Creek at Forest Home, and on the southernmost edge of the Cornell Orchards. These areas contain small spots or strips of somewhat droughty very gravelly soil, apparently representing gravel bars in an ancient stream course.

CgB — Chenango gravelly loam, 3–8 percent slopes

This unit occurs in three distinctive situations. On the Tailby farm north of Varna, it has been mapped on an undulating area of the high-level terrace where low knolls and shallow channels are intermingled. This area is very heterogeneous and includes many small spots of very gravelly soil. Along Fall Creek near Varna and Forest Home, the unit occupies long narrow gently sloping terrace faces. The slope contrasts strikingly with that of the nearly level adjacent terraces. Most of the small areas along Cascadilla Creek are low knolls that stand distinctly above the surrounding moderately wet soils, but the areas at the junction of Judd Falls and Dryden Roads slope gently toward the stream. All of these areas have a moderate to high degree of variability of gravel content and, consequently, of water-holding capacity.

CgC — Chenango gravelly loam, 8–15 percent slopes

This unit occupies a very limited aggregate acreage. It occurs on long narrow terrace faces. The soil profile on these terrace faces is not so well expressed as that on the more nearly level adjacent areas, and the content of gravel varies greatly from spot to spot.

CgD — Chenango gravelly loam, 15–35 percent slopes

The unit occupies long sinuous terrace faces on the Tailby farm north of Varna, the distinct escarpment south of the rose gardens, and a kame-like area near the southern edge of the Cornell Orchard. These areas are moderately to severely eroded; the surface soil is thin and light colored, and the color B grades into the gravel substratum at a depth approximating 3 feet. Comstock Knoll is included in this unit, although calcareous gravel occurs within 3 feet of the surface in most places and the soil would qualify as a member of the Howard series.

CtB — Chenango gravelly loam, over till, 3–10 percent slopes

This unit has been mapped where a Chenango-like profile overlies glacial till at a depth shallower than normal. The areas are typically on the gravel deposits of the bars and beaches of high-level glacial lakes. The largest areas are on the Warren farm, but distinctive areas also occur on the South Side Farm. Some small areas that do not represent beach deposits have been included along Cascadilla Creek where the thickness of gravel over contrasting till or lacustrine deposits is less than 8 feet. These areas are small, but they are significant locally from the standpoint of experimental work.

In most areas the till is deeper than 50 or 60 inches, and in these areas there is no evidence in the solum that the slow permeability of the till affects water relationships of the solum adversely. It would appear that water relations on this phase may be somewhat more favorable than those on many areas of normal Chenango soils. Locally the till may lie within 3 feet of the surface, but these spots should be considered inclusions of a moderately well drained soil too small to delineate. The coarse fragments are commonly finer than those typical of Chenango gravelly loam. There is also more local variation in texture than is typical of Chenango soils on the terraces.

Most areas have distinctive topographic expression. The slope is typically convex; it slopes toward the center of the glacial lake basin, and its gradient increases down slope. The largest area on the Warren farm lacks this expression. The slope gradient ranges from 3 to 10 percent; the slope range is greater than that of the comparable phase of Chenango gravelly loam because the configuration of the slope on these beaches typically causes the entire range to be present within a single mappable area. Two very small areas having slopes slightly in excess of 10 percent have been included on the Reed farm.

CvA — Chenango very gravelly loam, 0–3 percent slopes

These are areas on the terraces where the surface soil is more gravelly than normal. The areas are small but are highly significant to field experiments. Many other comparable areas too small to delineate have been included in the areas of Chenango gravelly loam. The small area near the State College fleet garage has a slope gradient slightly greater than 3 percent.

Collamer Series

The Collamer series includes moderately well drained soils in silty lake-laid material. Collamer is the moderately well drained associate of the well drained Dunkirk, the somewhat poorly drained Niagara and the poorly drained Canandaigua series. It is less clayey than the Hudson series.

The plowed layer from 0 to 8 inches is dark grayish-brown or very dark grayish-brown silt loam. It has moderate medium granular structure when in sod, but the structure is destroyed easily under intensive cultivation. This material is very erodible. From 8 to 12 inches is brown or yellowish-brown silt loam. This horizon is normally either free of mottles or has only faint grayish-brown mottles, indicating short periods of saturation. It has weak thin platy or very weak very fine granular structure. This horizon is like a very thin color B horizon. From 12 to 15 inches is light yellowish-brown silt loam with common distinct yellowish-brown mottles. This is nearly massive in some places and platy in others, but it is friable or only slightly firm. This is an A2 horizon of eluviation. From 15 to 30 inches is a textural B horizon of silty clay loam or heavy silt loam. It has moderate medium blocky structure. The blocks have brown clay coats and brown or dark grayish-brown distinctly mottled interiors. The upper few inches of this B horizon has few mottles in some places even though the A2 horizon above it is strongly mottled. This textural B horizon grades downward to a C horizon of varved silt or silt with very fine sand. The C horizon is calcareous at depths ranging from as little as 30 inches to as much as 60 inches. The soil above the textural B horizon is normally strongly acid, but pH increases in the B horizon with depth and is commonly above 6 at 30 inches.

As mapped in this area, the Collamer soils range from very silty profiles approaching Williamson to moderately fine textured profiles approaching Hudson. This gradation is apparent geographically within the area. Adjacent to the

areas of Williamson soils near McGowan Woods and at the eastern edge of Caldwell Field, the yellowish-brown color B is thick, and the textural B is at a depth of 18 or 20 inches in uneroded areas. In parts of these areas the textural B is also weakly expressed and moderately firm, its character approaching the fragipan of Williamson soils. Adjacent to the areas of Hudson soils in the Cornell Orchards, the textural B horizon is a well-expressed silty clay loam and is only 13 or 14 inches below the surface. Soil boundaries are not clearly defined in these places and have been drawn within relatively broad transitional zones. That between Collamer and Williamson soils has been drawn on the basis of distinctive topographic features in most places; that between Collamer and Hudson soils, on the basis of intensive sampling with the auger.

Textures vary strikingly within short distances, especially on the sloping areas. The original lake-laid material was stratified. Silt predominates, but layers of silty clay ranging from a fraction of an inch to as much as 2 feet thick occur among the beds of silt. Geological erosion has cut across these various strata, exposing silty clay at the surface in some places. Where the exposed clayey layers were extraordinarily thick, the topmost part of the profile resembles Hudson, but more silty material is encountered within the 3-foot section. Beds of very fine sand may be found at any point in the profile. Except where the beds of very fine sand or of silty clay are thick, they have been so thoroughly mixed with the silt layers that they are not conspicuous within the solum. In many spots, however, these inherited textures cause deviations from the generalized profile description given. The area of Hudson soil mapped near the southwestern corner of Caldwell Field represents one of the places where a thick layer of silty clay was exposed at the surface and was thick enough to provide a Hudson profile throughout the entire thickness of the solum. This is an extreme case; other smaller areas like it have been included in the Collamer mapping units at various spots as unmappable inclusions.

CoB — Collamer silt loam, 2–6 percent slopes

This is the most extensive unit of the Collamer series. It dominates much of the area from the beef barns to McGowan Woods and includes some of the areas used most intensively for experimental purposes. Here the Collamer soils occupy the convex land forms in association with somewhat poorly drained Niagara soils on the nearly level areas. The variations described under the series name apply to this unit. Most of the areas have had some degree of erosion, but in few places has it been enough that the 8-inch plowed layer rests directly on the textural B horizon. Mappable areas eroded to that degree have been separated as an eroded phase, but some unmappable eroded spots have been included in this unit.

CoBe — Collamer silt loam, 2–6 percent slopes, eroded

These are areas of Collamer soils having 2–6 percent slopes on which effects of erosion can consistently be recognized. All of the soil above the textural B horizon has been incorporated in the plowed layer, and in most places the upper few inches of the textural B horizon has also been turned by the plow. It is estimated that from 5 to 10 inches of soil have been lost on these areas. A new surface soil relatively low in organic matter and subject to serious crusting has developed under cultivation, and this 9-inch layer rests directly on the textural B. Though small in area, this unit is important in experimental work.

CoC — Collamer silt loam, 6–12 percent slopes, eroded

Though some isolated small areas of Collamer soils on slopes of 6 to 12 percent gradient have remnants of the A2 horizon between the plowed layer and the textural B horizon, essentially all of the unit has been eroded. In most places the plowed layer includes part of the textural B. Consequently, no uneroded phase of Collamer soils on these slopes has been recognized in the mapped area.

The surface soil is dark grayish-brown silt loam, distinctly lighter colored and lower in organic matter than is typical of the uneroded soil. Under clean cultivation, these areas are subject to continuing erosion. The areas are small and occur mainly as long narrow erosional land forms adjacent to intermittent drainageways. Though the areas are small, they occur within blocks used for experimental work and represent soil variation that should be significant in interpretation of the results. The area adjacent to the southern boundary of the Veterinary College is an inclusion of only slightly eroded soil. The area in the Cornell Orchard near the beef barns is one of the most severely eroded.

Dalton Series

The somewhat poorly drained Dalton soils, like Canaseraga, have formed in two materials, one above the other. The topmost 15 to 30 inches is in poorly graded silt and very fine sand. Below this layer is glacial till like that of the Erie soils. The soil is much like Erie, differing mainly in properties associated with the silty surface deposit. Dalton is the somewhat poorly drained associate of the moderately well drained Canaseraga series.

The plowed layer, from 0 to 8 inches, is dark grayish-brown silt loam containing few to many flat fragments like those found on the Erie soils. Where the silt mantle is thinnest, the fragments are most numerous. From 8 to 12 inches is pale brown or light yellowish-brown coarse silt loam or very fine sandy loam having very weak very fine granular structure. This horizon is very friable. It has common distinct yellowish-brown mottles, which are evidence of periodic wetness. Coarse fragments are commonly less numerous in this horizon than in the surface soil or in the underlying fragipan. From 12 to 15 inches is a similar but more highly mottled horizon of very fine sandy loam or coarse silt loam. This horizon is slightly lighter in color and contains more very fine sand than the horizon above. From 15 inches to a depth of 4 or 5 feet is a channery loam or channery light clay loam fragipan like that of the Erie soils. The fragipan is divided into very coarse prisms coated with light grayish-brown silt; the prisms themselves are massive and are very firm. The horizon is almost impermeable to water. Below it is glacial till comparable to that found under the Erie soils. The topmost 15 inches of the soil is strongly or very strongly acid, but pH increases within the fragipan and is greater than 6.5 at a depth of 48 inches. The C horizon is calcareous at some depth, but a zone leached of carbonates may be found between the pan and the calcareous till. In some areas the calcareous C is encountered at 40 inches.

The presence of moderately large numbers of flat stone fragments on the surface, relatively few or none of such fragments from 8 to 15 inches, and an abundance of fragments in the underlying fragipan is characteristic of most areas. Whether the channers in the surface have worked upward from the underlying till by frost action or are the result of mass-movement downslope on the surface, is undetermined. The thickness of the silty mantle ranges mainly from 15 to 24 inches, and

where the mantle is no thicker than 24 inches, the fragipan is entirely within the underlying till. Locally, as at the southern end of the Ketola farm, the mantle of silty material is 30 to 36 inches thick, and in these places the fragipan is partly in the silt. Such soils approach the Wallington series. On the greater part of the mapped area, the thickness of the silty layer is near the 15-inch minimum limit for the Dalton series. To emphasize that the soil generally is not characteristic of the central concept of the series, the units have been named "thin mantle" phases.

DA — Dalton channery silt loam, thin mantle, 0–3 percent slopes

These nearly level areas are the wettest of the Dalton soils and locally approach poor drainage, though the surface soil is not so dark as that of poorly drained soils. The areas have some slope and water moves from them slowly to adjacent lower-lying areas. The slopes are essentially uniform.

This is the dominant unit mapped south of the beach deposits on the Warren farm and across the southern parts of the Ketola and Fox farms. Slight knolls within this landscape are occupied by the moderately well drained Canaseraga soils. The unit is also prominent from the Game Farm southeastward along the southern boundary of the mapped area, where the areas occupy the same kind of land form but lack associated small knolls of Canaseraga soils.

DB — Dalton channery silt loam, thin mantle, 3–8 percent slopes

This unit occurs in the same general areas as Dalton channery silt loam, 0–3 percent slopes. Slope gradients are mainly from 3–5 percent in gradient but locally are as much as 8 percent. The slopes are long and uniform. These areas are slightly drier than those of the 0–3 percent slope phase, and the horizon immediately below the plowed layer commonly has slightly higher chroma. North of Fall Creek, the landscape is broken by small knolls of Canaseraga soil; such knolls are less conspicuous south of Cascadilla Creek. Dalton soils occur in limited areas on slopes greater than 8 percent in gradient, but these have been included with the 8–15 percent slope phases of Eric soils because of their limited extent.

Darien Series

The Darien series includes somewhat poorly to moderately well drained soils developed in moderately fine textured, moderately calcareous material that resembles glacial till. Darien soils are differentiated from Eric on the basis of their moderately fine texture and the presence of a distinct textural B horizon in the position in which the fragipan is found in Eric. In this area, the Darien is found in association with the soils from lake clays and silts, mainly where the lake deposits overlap the till of the region near the margins of extinct glacial lakes. It is believed that in most instances the parent material is not unmodified glacial till but is a composite of till and lake sediments that have been mixed mechanically postglacially.

The topmost 8 inches in plowed fields is dark or very dark grayish-brown gravelly silt loam moderately high in organic matter. From 8 to 12 or 13 inches is grayish-brown gravelly silt loam with many distinct yellowish-brown mottles, indicating that this horizon is frequently saturated. This is an A2 horizon. From 12 or 13 inches to 36 or 40 inches is a blocky gravelly silty clay loam or clay loam textural B horizon. The blocky structure is moderately expressed and the blocks are coated with clay films that indicate illuviation of clay. The interiors of the blocks have distinct or prominent mottles. Below 36 or 40 inches is a gravelly silty clay loam C horizon. This, like glacial till, is firm or very firm and slowly permeable. The topmost layers have been leached of lime, but free lime occurs within a 4 or 5 foot section.

DaB — Darien gravelly silt loam, 3–8 percent slopes

Small areas of this unit occur west and south of Varna, and south of Cascadilla Creek from the Game Farm to the Turkey Farm. All are near the elevation of the glacial lake beach. The areas near Varna are moderately eroded and have light-colored plowed layers resting directly on the textural B horizon. The aggregate acreage of all areas is small, but the unit is shown on the map for its significance in interpretation of the history of this area.

DaC — Darien gravelly silt loam, 8–15 percent slopes, eroded

Most of these areas have topography characteristic of the dissection forms of geologically eroded areas. On these land forms the plowed layer now rests directly on the textural B horizon. The complete Darien profile can be found in spots on these sloping areas, indicating that erosion, not slope itself, is the cause of the thin solum.

Dunkirk Series

Dunkirk is a well drained soil developed in lake-laid material dominated by silt. It is the well drained associate of the moderately well drained Collamer series.

The surface soil is dark grayish-brown silt loam. This is underlain to a depth of 12 inches by yellowish-brown or light yellowish-brown silt loam which is weakly granular and very friable. From 12 to 16 inches is pale brown silt loam which is commonly platy but friable. This is an A2 horizon depleted of clay. From 16 to 40 inches is a heavy silt loam or silty clay loam textural B. This has moderately expressed medium blocky structure, and the blocks have distinct clay coats. The textural B rests on stratified calcareous silt and very fine sand with thin lenses of clay.

The material in which Dunkirk soils form is slowly permeable, so the well drained Dunkirk soil is uncommon except on strongly sloping areas. A very limited area has been mapped. On slopes steeper than 40 percent in gradient, the genetic profile described is not consistently present in these materials, and the areas have been mapped as a land type of unclassified soil called 'Steep broken land, Dunkirk material."

DuA — Dunkirk silt loam, 0–3 percent slopes

This unit occupies a small area on a terrace of the Tailby farm. The silty profile has a weakly expressed textural B horizon which, unlike typical Dunkirk, lies on gravel at a depth ranging from 30 to 50 inches below the surface. The presence of the gravel substratum accounts for the good drainage, as good drainage would be essentially impossible on such a nearly level area if the silt extended to greater depth. It is probable that the sediment in which the solum has formed

in this area is not lacustrine in origin but is old river alluvium, because the area lies on a terrace that must postdate the glacial lake that covered the area. The Dunkirk profile, not the origin of the deposit, is the criterion for mapping.

DuD — Dunkirk silt loam, 12–20 percent slopes, eroded

This unit has been mapped on areas in the southern part of the Cornell Orchards and north of the Vegetable Crops gardens at East Ithaca. The steepness of slope is responsible for the good drainage, and even on these slopes, areas where water is concentrated may have some mottling in a three-foot soil section. The areas have been eroded, and the A2 horizon above the textural B is discontinuous. In most places the surface soil rests directly on the textural B. One small uneroded area is included.

DuE — Dunkirk silt loam, 20–40 percent slopes

This unit occupies the steepest slopes on which profiles within the range of the Dunkirk Series could be found on a high proportion of a mappable area. The areas have been subject to both soil creep and accelerated erosion; the degree of expression, thickness, and character of genetic horizons differ conspicuously within distances of a few feet. The unit occupies steep land forms of postglacial dissection along Fall and Cascadilla Creeks. The material is predominantly silty, but many small areas of steep Hudson soils can be found where clayey layers crop out of the slopes.

Ellery Series

Ellery is a poorly drained soil in glacial till. It occupies low-lying concave depressions in association with the better drained Erie and Langford soils, which dominate the landscape. It is the soil found most commonly along intermittent drainageways in the upland till areas.

A very dark gray silt loam plowed layer rests on a highly mottled gray and yellowish-brown loam, which is underlain by a fragipan at about 15 or 18 inches. The fragipan is divided into very coarse prisms whose surfaces are gray and free of mottles. The interiors of the prisms are mottled. Most of the areas have silty material washed from adjacent areas incorporated in the plowed layer. Where deposition has been greatest, the dark-colored surface soil is 20 inches thick. The Ellery soils are less acid than the associated better drained soils, presumably because water from adjacent areas brings bases to the depressions in which Ellery soils occur.

The Ellery soil is conspicuous in plowed areas by the distinctly dark color of the surface soil in contrast to the color of associated Erie soils. A few small areas of very poorly drained soil have been included and are indicated by wet-spot symbols on the map.

EA — Ellery channery silt loam, 0–3 percent slopes

This is the only unit in which the Ellery series could be mapped as a single kind of soil. It occurs in small areas intimately associated with larger areas of Erie and Langford or Canaseraga and Dalton soils. Where it is associated with Canaseraga and Dalton, the uppermost 10 to 20 inches of Ellery soils are in a silty or very fine sandy material very low in clay. In these areas, the very strongly mottled horizon immediately below the plowed layer is thicker than normal, and the fragipan lies at least 10 inches deeper than in typical Ellery soils.

Erie-Ellery Complex

This complex of soils occurs near the elevation of the beach of the glacial lake that once occupied the Cayuga basin. It is a very complex unit dominated by glacial till, the upper part of which appears to have been sorted by wave action with consequent removal of some of the fines. Somewhat poorly and poorly drained soils are intimately intermingled within small areas, and seep spots are common. Locally, areas too small to be shown at the scale of mapping have markedly sandy texture in the upper part, as if deltaic sand had been deposited and mixed with the till. In other places, similarly small areas have silty clay loam texture of the upper part of the solum, as if a thin deposit of clayey lake sediment had been mixed with the till. These small areas should be considered inclusions. Texture of the surface soil is a loam in most places, but it ranges from loam to silty clay loam within a few feet in some areas. The dominant soils, occupying about 90 percent of the aggregate area, however, are channery loam or channery silt loam types of Erie and Ellery. The proportion of Erie soil ranges from 40 to 80 percent of a delineated area. That of the poorly drained Ellery ranges from 10 to as much as 30 percent. Inclusions of sandy soils resembling a series called Junius and of clayey soils resembling Ilion occupy 5 to 20 percent of some areas.

EcB — Erie-Ellery complex, 0–5 percent slopes

The most complex area lies adjacent to the indistinct beach north of the farmstead on the Warren farm. Here the inclusion of Ilion soils is greatest, and sandy spots are also present. The area adjacent to the beach on the South Farm is also very complicated, including small areas of Ilion and a very large number of seep spots. This area has been tile drained. The other areas delineated are less complex.

Erie Series

The Erie series includes somewhat poorly drained soils in glacial till. Erie is the somewhat poorly drained associate of moderately well drained Langford and poorly drained Ellery. The plowed layer is dark or very dark grayish-brown channery silt loam. Beneath this and extending to a depth ranging from 13 to 16 inches is mottled grayish-brown and yellowish-brown, friable gravelly or channery silt loam. This rests on a very firm, slightly clayey fragipan divided by vertical cleavage planes into prisms 6 to 12 inches across. The prisms are coated with grayish-brown silt. Inside the silt coat is a brilliant yellowish-red band that forms the outer ¼ inch of each prism. The interiors of the prisms are faintly to distinctly mottled on a dark grayish-brown base. The upper part of the solum is normally medium or strongly acid, but pH increases within the fragipan to values of 6 or more. Calcareous glacial till underlies the fragipan at a depth ranging from 4 to 6 feet.

This is the dominant soil of that part of the till plain that is relatively little affected by a surface mantle of silt. The silt mantle characteristic of Dalton soils can be distinguished at some places in many of the areas mapped as Erie; such areas have been included in the Erie units if the silt mantle cannot be distinguished consistently from place to place. Silt deposits

may have affected most of the Erie areas, but in most places they appear to have been completely incorporated in the plowed layer.

ErA — Erie channery silt loam, 0–3 percent slopes

This is the wettest of the Erie soils. It approaches poorly drained Ellery in wetness, and has been separated from Ellery largely on the basis of its lighter-colored surface soil. Most areas have measurable slope, though any slight obstruction to runoff, such as a back furrow, holds water and keeps the adjacent soil wet. The phase occupies significant acreages both in the northern and in the southern parts of the mapped area.

ErB — Erie channery silt loam, 3–8 percent slopes

This is the most common phase of the Erie soils. Its wetness is characteristic of the center of the somewhat poor drainage class. The soil is distinctly less wet, surface soil colors are slightly lighter, and the chroma of the subsoil is slightly higher than in areas of the nearly level phase. Most areas mapped are probably slightly eroded, but the depth to the fragipan is not consistently less than in the uneroded soil. Small areas of moderately eroded soil are included; most of these could not have been delineated because of their small size.

ErC — Erie channery silt loam, 8–15 percent slopes

This phase occupies small individual areas, and the aggregate acreage is small. It represents the best drained one-third of the range of Erie soils and approaches the Langford series in character. It is differentiated from Langford on the basis of distinct mottling immediately below the plowed layer. Depth to the fragipan is like that described for the series. Most areas have had some erosion, but not enough to permit delineation of mappable areas in which depth to the fragipan is consistently less than that of the uneroded soil.

ErCe — Erie channery silt loam, 8–15 percent slopes, eroded

This eroded equivalent of the 8-15 percent slope phase is differentiated on the basis of thinness of the upper part of the solum over the fragipan, accumulation of flat stone fragments on the surface, and slightly lighter-colored surface soil than is typical of the uneroded phase. Depth to the fragipan is 12 inches or less in most places, and surface soil colors are mainly dark grayish-brown when moist. The volume of soil well suited to development of good root systems is significantly less than that in the uneroded phase. This, like the uneroded phase on similar slope, falls within the dryest one-third of the range of the series.

Hudson Series

The Hudson series consists of moderately well drained soils in clayey lake-laid material. Hudson is the clayey analogue of the silty Collamer soils. Where unplowed, the topmost four inches is very dark grayish-brown heavy silt loam and is underlain by 4 to 6 inches of pale brown silt loam A2 horizon, which is faintly mottled with yellowish brown. This light-colored silty material encloses darker-colored blocks of silty clay like that of the underlying B horizon and extends into cracks in the B horizon. The underlying dark brown textural B is a strongly or moderately blocky silty clay. The blocks have thick clay skins. The upper part of this horizon is typically nearly free of mottles, but the interiors of the blocks are mottled below 15 or 18 inches. The B horizon rests on calcareous varved silty clay lake sediment at a depth ranging from 20 to 30 inches. In some areas the A2 horizon has formed in a contrasting deposit of silty or very fine sandy material, like that of Collamer soils. In plowed fields where this deposit is absent, most or all of the A2 horizon has been incorporated in the plowed layer.

HA — Hudson silt loam, 0–2 percent slopes

Normally a moderately well drained soil will not develop in such slowly permeable material on such nearly level land. This unit is found only on a terrace of the Tailby farm near Dryden road where a silty clay or silty clay loam deposit overlies gravel. The underlying gravel accounts for the good drainage of the nearly level area.

HB — Hudson silt loam, 2–6 percent slopes

This is the most extensive of the Hudson soils. It is prominent on the South Farm, on the Savage farm, and in the Cornell Orchards, where it occupies extensive areas of relatively uniform soil. The areas are on distinctly convex land forms situated in places where little or no runoff is received from higher-lying adjacent land. They occur most commonly on the highest portions of the landscape or near major dissection forms of Fall and Cascadilla Creeks or of their tributaries. Most of the areas have had some erosion, but except in a few spots, erosion has not been sufficient to cause mixing of the silty clay subsoil with remnants of the surface soil during plowing. The plowed layer is typically a silt loam, though it is in the more clayey part of the range of that textural class. An area that lies across Caldwell Field Road near its junction with Dryden Road is eroded to an extent that the plowed layer is a silty clay loam. Evidence of erosion is also apparent in the light color of the surface soil in this area. A similar area occurs along Cascadilla Creek at the eastern edge of the Game Farm. The small area immediately south of the Vegetable Crops gardens is also eroded. A number of eroded spots too small to delineate occur in other areas. These are mainly a few tens of feet across at points where the slopes break most sharply and approach the 6 percent slope limit of the phase.

HC — Hudson silty clay loam, 6–12 percent slopes, eroded

The individual areas of this unit are small. They occupy slopes adjacent to distinct dissection forms or along intermittent drainageways that have cut into the lake plain. They are most numerous near Varna, along the short intermittent drainageways adjacent to Cascadilla Creek, on the sides of the intermittent drainageway that runs southwestward across Ellis Hollow Road near the Artificial Breeders headquarters, on the Savage farm, and on the eastern end of the Fox farm. This last area has only a moderately thick deposit of lake sediment over till, and there has been some mixing of the till with the lake deposit on it. The soil in this area approaches Darien, but it is fine enough to be included in the Hudson series.

Essentially all of these areas have been eroded; part of the

B horizon has been incorporated in the plowed layer, and the surface soil texture is mainly silty clay loam. In most areas, the surface soil is distinctly lighter in color than that of normal Hudson soils, and unless the soil has been in sod-forming crops, the surface soil has poor structure.

HD — Hudson silty clay loam, 12–20 percent slopes, eroded

This unit occupies moderately steep slopes of dissection forms, mainly near Varna, on the Savage farm, and adjacent to Cascadilla Creek west of Town Line Road. The areas are places where side streams are cutting into the lake plain as they descend to the major streams of the area. Essentially all of the areas are moderately to severely eroded.

HE — Hudson silty clay loam, 20–40 percent slopes

This unit occupies steep dissection forms in clayey lake sediments along the major streams. In spite of the steepness of slope, the horizons of Hudson soils have formed, though soil creep and accelerated erosion have modified them in many places. Most of the unit is moderately or severely eroded.

The Hudson profile is the dominant one, but steep soils of the Dunkirk series are included in some places. The sediments are stratified silts and clays, and these steep slopes cut across the bedding planes exposing varying thicknesses of the silt and clay strata. Consequently, most areas contain some steep Dunkirk soil where thick silt layers have been exposed.

Ilion Series

Ilion is the poorly drained associate of Darien soils. It has a very dark gray surface soil about 6 inches thick over gray very highly mottled gravelly or channery silty clay loam subsoil. The solum is nearly neutral, and calcareous silty clay loam underlies the soil at a depth ranging from 30 to 40 inches. In this area the Ilion soil appears to represent a mixture of clayey lacustrine material with loamy glacial till at the margins of the ancient lake or at places within the lake basin where the veneer of lacustrine sediment was thin over till.

IA — Ilion gravelly silt loam, 0–3 percent slopes

An area east of Town Line Road north of Cascadilla Creek and two small areas at the southern edge of the Warren farm have been included in this unit. A number of small spots, in areas too small or in patterns too complicated to be delineated, also occur in the Erie-Ellery complex but have not been separated on the soil map. The unit occurs as wet areas of moderately fine texture that contrast markedly with adjacent soils.

Langford Series

Langford is a moderately well drained soil in channery loam glacial till. It is the moderately well drained associate of the somewhat poorly drained Erie soils, which are dominant on the glacial till in this area.

The plowed layer is dark grayish-brown or very dark grayish-brown channery silt loam. From 8 to 12 or 15 inches is a friable yellowish-brown channery silt loam color B, which is free of mottles. From 12 or 15 to 16 or 20 inches is grayish-brown or dark grayish-brown channery loam having common distinct yellowish-brown mottles indicative of periodic wetness. This rests on a very firm channery loam fragipan at a depth ranging from 16 to 20 inches. The pan is divided into prisms 6 to 12 inches across, and these prisms are coated with grayish-brown silt like that of the horizon above. Inside the silt coat is a $\frac{1}{4}$-inch yellowish-red band, which gives the appearance of mottling in the subsoil. The centers of the prisms are grayish-brown nearly structureless channery loam. These prisms are very firm or extremely firm and the horizon is an effective barrier to downward movement of water. The pan extends to a depth of 4 or 5 feet and rests on channery loam glacial till that is equally firm and slowly permeable. The upper part of the solum is strongly or very strongly acid, but pH increases with depth within the fragipan and is commonly above 6 at a depth of 30 inches. The underlying till is calcareous at some depth, but a zone leached of carbonates may be found between the fragipan and the unleached till. Stone fragments include both flat channers and rounded gravel in this area.

A moderately well drained soil cannot develop in such slowly permeable material on level topography. Essentially all areas have convex configuration and slopes that are greater than 3 percent in gradient. These areas receive little water as runoff from higher-lying land and dispose of some of the water that falls on them by runoff to lower-lying areas.

LB — Langford channery silt loam, 3–8 percent slopes

This unit is representative of the center of the range of the series. On the Ketola farm and on the eastern part of the Warren farm it occurs principally as very small knolls surrounded by Erie soils. On the central part of the Warren farm it occupies more extensive areas. From the beach on the Warren farm northward through the Warren farm woods, the soil is somewhat influenced by a mantle of silt too thin to permit recognition of the Canaseraga series. Other areas occur south of Cascadilla Creek in association with the Erie soils. Though most of the unit has probably been eroded to some degree, it was not possible to map an eroded phase whose depth to the fragipan is consistently less than that normal for the series.

LC — Langford channery silt loam, 8–15 percent slopes

This unit occurs as small moderately sloping areas on glacial till. It is a slightly better drained soil than the 3–8 percent slope phase. It has 4 to 10 inches of unmottled material below the plowed layer, distinct mottling being confined to a thin zone immediately above the fragipan. A high proportion of the areas mapped have some evidence of a thin mantle of silt on the surface, but this is not consistently thick enough to permit recognition of the Canaseraga series. Most areas probably have had some erosion, but the soil is not measurably thinner than normal above the fragipan in consistently mappable areas.

LCe — Langford channery silt loam, 8–15 percent slopes, eroded

This unit includes areas on which the fragipan is consistently within 15 inches of the surface and the yellowish-brown color B horizon is lacking. In many areas the fragipan lies immediately

below the plowed layer. The phase is comparable to the 8–15 percent slope phase in drainage and represents the driest half of the moderately well drained class. Thinness of soil above the fragipan restricts the capacity of the soil to supply moisture for plants.

LD — Langford channery silt loam, 15–25 percent slopes, eroded

The areas of this unit are small but are significant locally. The unit is mapped principally on dissection forms adjacent to streams. These areas are almost everywhere eroded to a degree that the surface soil either rests directly on the fragipan or is separated from the fragipan by less than 6 inches. The yellowish-brown color B horizon is generally absent. Surface soils are distinctly lighter colored than those of uneroded soils on more gentle slopes.

LgB — Langford gravelly loam, 2–8 percent slopes

The gravelly loam type of the Langford series is a special case associated either with the ancient beaches of the area or with areas adjacent to small streams where running water has been a factor in conditioning the material. A thin layer of gravelly loam has been deposited on till by running water in some places; in others it appears that wave action may have removed some of the silt of glacial till, leaving a gravelly loam surface soil. Gravelly loam or channery loam is the dominant texture above the fragipan, which is commonly 6 to 12 inches deeper than that normal for Langford soils.

The unit is associated with the somewhat poorly to poorly drained areas of the Erie-Ellery complex. The largest areas are on the western part of the Warren farm, on the Behavior Farm, and in the southeastern corner of the mapped area near Ellis Hollow Road. This latter area appears to be a case where stone fragments have been rounded by water and where silt has been deposited on the surface; the texture is more nearly a gravelly silt loam than a gravelly loam.

Madalin Series

Madalin is a poorly drained clayey soil in lake-laid material. Where unmodified it has a very dark gray, 6-inch silty clay loam or silt loam surface soil. This overlies gray silty clay or silty clay loam with many distinct and prominent yellowish-brown mottles within well-expressed coarse prisms. Typically the underlying material is calcareous at a depth ranging from 24 to 36 inches. The soil occurs mainly along the small drainageways on the lacustrine plain, but locally it is found as small nearly level areas without distinct drainage patterns. Most areas mapped have received a deposit of silt loam material from surrounding areas and have a dark surface soil 15 to 24 inches thick.

MaA — Madalin silt loam, 0–2 percent slopes

The long narrow sinuous areas shown on the map along the drainageways of the Reed, Helfer, and South farms are typical of this unit. The broader area on the northwestern side of the Warren farm is atypical in that fine textured material is mixed with gravel. It probably represents either a former stream course where a thin veneer of gravel was deposited on the surface or an area where the thickness of lacustrine sediment over glacial till is thin.

Undrained areas are too wet to be used for most annual crops, but most of the areas have been improved, either by artificial drainage, by the accumulation of surface material washed from adjacent slopes, or by the removal of excess water through road ditches. The land is cultivated across these wet depressions, but the depressions commonly determine the date in the spring when the entire field in which they occur is ready for cultivation. These areas contrast strikingly with the adjacent Rhinebeck and Hudson soils, and great care should be exercised that experimental plots do not extend across them into Madalin areas.

Middlebury Series

Middlebury is a moderately well to somewhat poorly drained soil in young medium textured alluvium. It is normally associated with the well drained Tioga soils in similar material on flood plains. The plowed layer is very dark grayish-brown or grayish-brown silt loam and has good physical condition. It is underlain by a weakly expressed brown or pale brown silt loam color B horizon. The color B is normally free of mottling in the upper part but is mottled at a depth of 15 or 18 inches; Middlebury soils are differentiated from Tioga on the basis of this mottling. The color B is very weakly expressed, dominantly being only 1 unit of chroma brighter than the underlying material. The upper part of the solum is acid, but pH increases with depth and is above pH 6 at 30 inches in most areas of this project. The entire soil is very friable or friable and has good water-holding capacity.

MA — Middlebury silt loam, 0–2 percent slopes

These are soils of the typical first bottom lands and are subject to flooding annually. Most of the areas are along Cascadilla Creek. These areas are so intimately associated with the very crooked course of the stream that they are generally not suitable for cultivation.

MhA — Middlebury gravelly loam, high bottom, 0–3 percent slopes

This soil occurs principally on the intermediate terraces of the Lamkin farm and near the University water plant. The total area is small, but the individual areas are intimately associated with the better-drained Tioga soils and are important from the standpoint of uniformity of fields that are used for experiments. On these intermediate terraces, the well-drained Tioga soils typically are strongly acid throughout the three-foot section, but the wetter Middlebury soils apparently receive water charged with bases, and pH in them increases with depth. The areas of this unit are much higher in gravel than is normal for the series, a condition typical of the intermediate terraces along Fall Creek. The term "high bottom" is used to indicate that these soils lie above the level that is frequently flooded. Although flood water covers them during the highest flood stages of Fall Creek, such flooding is infrequent. Some of the areas have probably not been flooded within the past 20 years.

Muck

Only shallow muck has been found in the area.

Mu — Muck, shallow

This unit includes very small spots of very wet soils where more than 12 inches of organic material has accumulated. None seen has more than 24 inches of muck over mineral soil. A long narrow area was mapped adjacent to the upland on the Tailby farm; the muck of this area overlies silt loam or silty clay loam highly gleyed inorganic material. This seemingly was an ancient stream channel.

Niagara Series

The Niagara series consists of somewhat poorly drained soils in silty lake deposits. It is the somewhat poorly drained associate of the moderately well drained Collamer and the silty analogue of the clayey Rhinebeck series. In this area Niagara is found mainly along intermittent drainageways or on nearly level areas that lie lower than surrounding landscapes. It has been mapped on Caldwell Field, the McGowan farm, the Snyder farm, and the Game Farm, where it is associated with low ridges of Williamson as well as with Collamer soils.

The 8-inch plowed layer is dark grayish-brown or very dark grayish-brown silt loam. From 8 to 12 or 13 inches is a light brownish-gray friable silt loam A2 horizon that has distinct mottles. From 12 or 13 inches to depths ranging from 24 to 40 inches is a weakly expressed textural B horizon which is typically a heavy silt loam or light silty clay loam with moderate medium blocky structure. In many areas inherited stratification of silt and very fine sand gives the B horizon a crudely thick or very thick platy structure within the blocks of the B. The underlying material is stratified silt and very fine sand with thin lenses of clay. The profile is typically slightly acid in the upper part but becomes less acid with depth and is calcareous at a depth ranging from 24 to 40 inches.

NA — Niagara silt loam, 0–2 percent slopes

This nearly level phase is typical of areas adjacent to intermittent drainageways. It is the wettest of the Niagara soils and corresponds mainly to the wettest half of the somewhat poor drainage class. It differs from associated Canandaigua soils, which are poorly drained, in not having a nearly black surface soil and in having slightly brighter chroma in the subsoil. Locally, especially along the narrow drainageways, material washed from adjacent higher-lying areas has accumulated on the surface to give a moderately dark colored surface soil as much as 12 inches thick.

NB — Niagara silt loam, 2–6 percent slopes

This phase represents the driest half of the somewhat poorly drained class. It is differentiated from Collamer on the basis of presence of distinct or prominent mottling throughout the A2 and B horizons and duller chroma on the ped faces of the B.

This phase is most extensive on the Snyder and Game farms. The silty parent material intergrades gradually to the silty clays that give rise to Rhinebeck soils on the western edge of the Helfer farm and on the southern part of the Game Farm. In these places, the boundary between the Niagara and Rhinebeck soils is very indistinct, and Niagara has been mapped where texture of parts of the B horizon is a distinct silty clay loam, approaching the clay content of Rhinebeck soils, if layers of silt or very fine sand are conspicuous.

Most of the areas mapped have little evidence of erosion, but the area on the Game Farm where the Lehigh Valley railroad crosses Cascadilla Creek has lost enough surface soil that the B horizon is very near or partly incorporated in the plowed layer. This area is also quite variable in texture. It includes some spots that could be classified as Rhinebeck as well as numerous spots that have gravelly material on the surface.

Red Hook Series

The Red Hook soils are somewhat poorly to poorly drained, medium textured soils in gravelly deposits. They are associated with the well drained Chenango and moderately well drained Braceville series. The plowed layer is very dark grayish-brown gravelly loam in most areas, but small areas having dark gray or very dark gray surface soils are included. Beneath the surface layer is a gray highly mottled gravelly silt loam subsoil, which rests on poorly assorted gravel, sand, or silt. The soil occupies low-lying positions and is underlain at depths ranging from 30 inches to several feet by slowly permeable material.

RhA — Red Hook gravelly silt loam, 0–3 percent slopes

The largest area is at the northern edge of the Turkey Farm, where gravelly material has been deposited over lacustrine silt and clay. The gravelly deposits on the Turkey Farm are thickest near Cascadilla creek where Chenango soils have been mapped. In the lowest-lying associated areas, where the gravel deposit is probably thinnest over clay, the Red Hook series has been mapped. In a deep excavation in this area, a poorly assorted gravelly deposit about 5 feet thick was found over the lacustrine material. It will be noted that gravel symbols have been used on the adjacent area of Canandaigua soil to indicate that the gravel extends beyond the Red Hook area. The boundary between the Red Hook and Canandaigua areas was drawn where lacustrine silts were encountered within a 30-inch vertical section. The thickness of gravel probably decreases from north to south across the Red Hook area.

The small area at the southern edge of the Tailby farm is a place where water seeps from the adjacent upland. Another very small area occurs adjacent to the farm pond on the Warren farm; the southern half of this is very wet.

Rhinebeck Series

This is a somewhat poorly drained soil in clayey lake-laid material. It is one of the most extensive series on lake sediments in this area. It is the fine-textured analogue of the Niagara Series and is associated with the moderately well drained Hudson and poorly drained Madalin series.

In undisturbed areas, the profile has about four inches of very dark grayish-brown silt loam A1 horizon overlying 3 to 5 inches of lighter colored A2. The A2 rests abruptly but irregularly on a blocky silty clay textural B. Both the A2 and B horizons are strongly mottled. The mottling in the B horizon is within the blocky peds; clay coats on the peds are typically grayish-brown and lack mottles. In most plowed areas the A2 horizon has been completely incorporated in the plowed layer,

only remnants being distinguishable locally where they extend in V-shaped bodies into the B horizon. Some areas, especially those nearest the parts of the lake basin dominated by silts, had a deposit of silt loam as much as 14 inches thick over silty clay, and in these places the A2 horizon was thicker and is still evident in areas that have been plowed.

The areas of Rhinebeck soils within any one locality are generally moderately uniform. Over greater distances, however, there are important variations. Generally, the areas farthest from the large block of Collamer soils are the highest in clay and have heavy silt loam A horizons over well expressed and generally uninterrupted silty clay subsoils. In these areas calcareous material commonly occurs at a depth of 30 inches. These would be typical of the areas on the Savage farm, the Fox farm, and the southernmost areas of the South Farm. The areas near Cascadilla Creek on the South Farm, near the Game Farm, and in the Cornell Orchards, however, commonly have layers of silt ranging from a fraction of an inch to several inches in thickness interbedded with the silty clay. These may be encountered at varying depths within the profile. Where these silt layers are prominent and tend to dominate the profile, the soils have been mapped as Collamer. Lenses of silt up to several inches in thickness are allowed in the Rhinebeck soils, however. These are common in parts of the Cornell Orchard, where the boundary between the Collamer and the Rhinebeck soils could have been drawn with equal precision within a relatively broad zone. On the Savage farm, the sediments contain reddish layers, and in spots the colors approach those of the reddish Odessa series.

RA — Rhinebeck silt loam, 0–2 percent slopes

This nearly level phase is the wettest of the Rhinebeck soils; it approaches the poorly drained Madalin series in wetness. It is differentiated from Madalin on the basis of lighter color of the surface soil and slightly higher chroma on the ped faces in the textural B horizon. It is within the wettest one-half of the range of somewhat poorly drained soils. The area mapped is limited, as most soils on such nearly level areas are poorly drained and would be classified as Madalin. The areas mapped are not eroded and some areas have thick surface soils due to addition of material washed from adjacent areas.

RB — Rhinebeck silt loam, 2–6 percent slopes

This phase occurs on very slightly convex slopes or on uniform slopes adjacent to higher-lying land. It is dominated by profiles near the central concept of the Rhinebeck series. On the most convex topographic positions, the color of the B horizon approaches that of Hudson. On the northern part of the South Farm and near the Game Farm, the A2 horizon is in a mantle of silt and is thicker than normal.

Most of the areas have had some erosion, as evidenced by accumulation of material in adjacent low-lying areas. The removals have not been sufficient that eroded areas can be differentiated consistently from uneroded soil on the basis of depth to the B horizon.

RBe — Rhinebeck silty clay loam, 2–6 percent slopes, eroded

This unit has distinct evidence that part of the B horizon has been incorporated in the plowed layer. The texture of the plowed layer is slightly finer than that of the uneroded soil on similar slopes and is classified as a silty clay loam. The surface soil color is not consistently lighter than that of the uneroded phase, but soil tilth is generally poorer.

RC — Rhinebeck silty clay loam, 6–12 percent slopes, eroded

Almost all of the Rhinebeck soil on these slopes has been eroded, and most has been eroded enough that part of the B horizon has been incorporated in the plowed layer. This phase represents the dryest one-third of the somewhat poor drainage class and is the driest of the Rhinebeck soils. It approaches the Hudson series in many places, and small spots of Hudson soil are common within delineated areas.

RoA — Rhinebeck silty clay loam, overflowed, 0–2 percent slopes

This phase of the Rhinebeck series is in alluvium derived from lake-laid sediments. The soil has stronger prismatic structure and weaker blockiness than is typical of Rhinebeck soils, but it has enough evidence of clay eluviation to justify inclusion in the Rhinebeck series. The areas lie among the intricate meanders of Cascadilla Creek on the Reed farm below a short steep escarpment that marks the boundary with Rhinebeck soils at higher elevations. The areas are subject to flooding in the spring.

Steep Soils, Unclassified

Where the slopes are so steep that it was impossible to differentiate a distinctive soil profile consistently, the areas were included in miscellaneous land types, which are unclassified as to soil series. The character of the material is indicated in the name of the unit.

Sc — Steep broken land, Chenango material

The steep slopes on the west side of Comstock Knoll and in Varna as well as a few steep dissection forms have been included in this land type. The unit consists of areas of water-worked gravel comparable to that under Chenango soils. Slopes are mainly 35 to 60 percent in gradient. Geologic erosion has prevented development of a distinctive genetic profile in most places.

Sd — Steep broken land, Dunkirk material

This unit occupies escarpments in predominantly silty lake deposits where slope gradients are mainly 30 to 60 percent. The material is very unstable and has been subject to mass-movement and mixing. Genetic profiles comparable to those of Dunkirk soils are identifiable in some places but are not consistently present. Most of the areas appear to be stabilized by vegetation, but soil slips can be expected to occur. On at least some of the areas, only the upper part of the slope is on a thick deposit of silty lake-laid material; masses of silty material have moved downhill and have buried glacial till that would otherwise be exposed on the lower part of the slope. Beds of very fine sand and of clay also occur on these slopes and contribute to sandy and clayey inclusions. The largest areas are south of the Cornell Orchards, and north of Fernow and Rice Halls.

Sh — Steep broken land, Hudson material

These are areas having slopes between 25 and 60 percent gradient on predominantly clayey material comparable to that of the Hudson series. On at least some of the areas, only the upper part of the slope is on a deep lake-laid deposit; on the lower part, glacial till is buried at varying depth beneath silty clay that has moved down slope. The slopes are inherently unstable although most appear to be stabilized by vegetation at the present time.

Ss — Steep broken land, shallow to bedrock

A few small steep areas where the interbedded shale and sandstone of the country rock are exposed or lie less than 24 inches below the surface have been included in this unit. They are places where streams have cut into country rock below the mantle of glacial deposits. Unconsolidated material moving down the steep slope has left a thin veneer of soil adequate for plants to develop in most places, but bare rock is exposed at some points. The earthy material is predominantly comparable to the channery loam of Langford and Erie soils.

Sv — Steep broken land, Valois material

Most of the steep escarpment-like areas along the valley of Fall Creek and smaller but comparable areas along Cascadilla Creek are included in this unit. Slopes are mainly between 35 and 70 percent in gradient. In some places the entire slope has been cut in a deep deposit of glacial till comparable to that of Valois and Langford soils. In others, only the upper part is deep till; on the lower parts in these places till-like material derived from deposits at the top of the slope covers bedrock to depths of several feet. Small areas where unconsolidated material is shallow over rock have been included. Much of the unit is forested.

Tioga Series

The Tioga Series includes well drained medium textured soils in alluvial deposits young enough that profile development is weak. In this area, Tioga soils occupy the best drained sites on both the "high bottoms" subject to very infrequent overflow and the lowest terraces that flood frequently.

The surface soil is dark grayish-brown or very dark grayish-brown silt loam or gravelly loam. It rests on grayish-brown or light grayish-brown silt loam or gravelly loam, which is about one unit of chroma brighter than the underlying substratum. The subsoil is a very weakly expressed color B horizon. The entire solum is strongly acid to a depth of at least 3 feet on the higher terraces, but pH values increase with depth to about 6 at 3 feet on the lower terraces.

TA — Tioga silt loam, 0–3 percent slopes

This soil has been mapped adjacent to Fall Creek east of Varna. It occurs principally on inaccessible areas, bounded on one side by a steep slope to the upland and on the other by the stream channel. The stream meanders from the escarpment on the north to that on the south, obstructing access to these areas. Accessible areas have been used as a source of topsoil for landscaping and for greenhouse soil.

TgA — Tioga gravelly loam, high bottom, 0–3 percent slopes

This is a major soil of the cultivated areas along Fall Creek on the Tailby farm, the Lamkin area, the rose gardens, and areas adjacent to Forest Home. The areas are nearly level and are predominantly moderately gravelly. The mapped areas contain many spots that have exceptional quantities of gravel, and the largest of these have been shown by gravel symbols. Most areas are quite heterogeneous in gravel content and in water-holding capacity.

TgB — Tioga gravelly loam, high bottom, 3–8 percent slopes

This, like the 0–3 percent slope phase, occupies the intermediate terraces and is moderately gravelly. On the Tailby farm it is mapped principally on short gently sloping terrace faces. On the Lamkin area it occupies long low ridges or knolls within the generally level high-bottom area. At Forest Home the area is cut by small channels and has uneven topography. The unit occupies either terrace faces or bars of moderately gravelly material laid down by running water.

TvB — Tioga very gravelly loam, high bottom, 1–5 percent slopes

Though these areas are very gravelly, they contain enough fine material that water-holding capacity is at least moderately good. On the Lamkin area, low, narrow ridges are separated by very shallow depressions a few tens of feet across; the individual slopes are very short.

Valois Series

This is the well drained associate of Langford and Erie soils on glacial till in this area, but the till in which Valois soils have formed is not so dense and slowly permeable as that under Langford and Erie. The Valois soils are most commonly found on distinctly rolling or hilly topography suggestive of recessional or ablation morain, and the material commonly contains layers of water-sorted material.

The plowed layer is dark grayish-brown channery silt loam. Below it and extending to 24 inches is a yellowish-brown channery or gravelly silt loam color B horizon. It is permeable and friable and is very strongly acid. Below 24 inches is dominantly brown to grayish-brown gravelly or channery loam within which are patches of darker brown distinctly more clayey material with clay films in pores. This appears to be a horizon of slight clay illuviation. Illuvial clay is most conspicuous where the material has distinct evidence of water sorting. Where silt is more abundant, the horizon is firm and has weak fragipan character. On distinctly rolling morainic topography, this horizon extends to 6 feet or more, with inclusions of thin fragipan-like layers in some places, and the underlying material commonly contains water-sorted layers. On uniform slopes the soil appears to be in thinner morainic deposits and rests on firm slowly permeable basal till at a depth of 3½ or 4 feet. The upper part of the soil is very strongly acid, but pH increases with depth and is generally above 6 at 4 feet. The substratum is mildly calcareous at a depth ranging from 5 to 10 feet.

VB — Valois channery silt loam, 3–8 percent slopes

This unit occupies small areas south of the Turkey Farm. The topography is sharply undulating, and a considerable part approaches the 8 percent upper limit of the phase. Locally the upper part of the soil appears to be in a thin deposit of silt. About 20 percent of the largest of the five areas shown is eroded, the eroded spots occurring on very short sharply convex parts of the undulating landscape. The aggregate acreage is small.

VC — Valois channery silt loam, 8–15 percent slopes

A small area of this soil has been mapped north of Caldwell Field on a land form that appears to be an ancient landslide on the escarpment bordering Fall Creek valley. This area is quite heterogeneous and contains spots of very silty material similar to that of the Williamson soils. The largest area is on the spur of the upland that extends into the Tailby farm immediately south of Fall Creek. This area is forested and is essentially uneroded. A silty surficial deposit is conspicuous on this area. A small area occurs on the Reed farm on a distinct dissection form, and this area is severely eroded. As the total acreage of Valois soil on these slopes is small, the unit is undifferentiated with respect to erosion.

VD — Valois channery silt loam, 15–25 percent slopes

This unit also occupies a limited area. One area lies north of Caldwell Field. This is moderately eroded on the upper part of the slope but has had little erosion on the lower part. It, like adjacent areas, is quite complex texturally. A severely eroded area occupies the sides of an incised drainway in the northeastern corner of the Reed farm. The largest area is on the upland between the Tailby farm and Fall Creek. This is forested and is essentially uneroded. A fourth area occurs at the north end of the Smith-Guimp tract east of the rose gardens. This is moderately eroded. Another small uneroded area was mapped in the forested area south of Fall Creek. All of these areas are associated with dissection forms of the uplands.

VE — Valois and Darien soils, 25–35 percent slopes

This unit includes both Valois and Darien on steep slopes. The slope is so dominating that the difference between the silt loam profiles of Valois and the silty clay loam profiles of Darien were not considered important enough to justify two units. All of the areas are associated with the dissection forms along Fall Creek and its tributaries. One small area north of Caldwell Field is predominantly the Valois soil. That forming the southern and eastern walls of the amphitheatre-like basin south of the rose gardens is a complex of Valois and Darien soils, textures ranging from silt loam to silty clay loam within relatively short distances. The southern part of this area contains a number of seep spots. The other principal area is at the northeastern side of the Tailby farm where the upland slopes abruptly to the valley of Fall Creek. This is essentially all Valois soil at the northern edge of the area, but near Dryden road, the area is dominated by Darien.

Wallington Series

The Wallington soils are the somewhat poorly to poorly drained associates of Williamson and Amboy. They have formed in stratified coarse silt and very fine sand. Only a very few small areas have been mapped; the aggregate acreage hardly justifies recognition in the legend.

The surface soil is very dark grayish-brown uniform silt loam or very fine sandy loam. It rests on a mottled light yellowish-brown and grayish-brown horizon of very fine sandy loam, which overlies a silty fragipan. The profile is acid. In this area the silt undoubtedly overlies glacial till at a depth much less than that normal for the series.

WaA — Wallington silt loam, 0–2 percent slopes

One relatively extensive area associated with the Dalton soils on the Ketola farm provides the greatest part of the acreage of this unit. Small areas occur in similar positions on the Warren farm. The soil occupies depressions where silts similar to those of the associated Canaseraga soils have accumulated. The Wallington series has been used where the thickness of silt mantle is great enough to permit formation of a distinct fragipan in the silty material above the till.

Wayland Series

Wayland is a poorly drained soil of the first bottom lands. The surface soil is very dark gray to almost black silt loam or silty clay loam. This is underlain by gray or grayish-brown silt loam or silty clay loam strongly mottled with yellowish-brown. The profile is neutral; the soil is very wet.

Normally the acid Holly soils are the wet associates of Tioga and Middlebury on flood plains, but in this area, the wet soils are maintained near neutrality by bases in the water that moves from base-rich deposits of the upland to these low-lying areas.

WA — Wayland silt loam, 0–1 percent slopes

Along Cascadilla Creek near the eastern edge of the mapped area, the Wayland soil occupies the long narrow depressions of abandoned stream channels in the flood plain. One exception is a large wet area south of Cascadilla Creek, where a side stream enters the nearly level floor of the valley. This area merges with an area of muck on the east. The largest single area includes the fish ponds near Judd Falls Road.

Williamson Series

The Williamson series includes moderately well drained soils in coarse silt and very fine sand with little clay. Williamson soils occur on slightly convex topography in the glacial lake basin and are associated with areas of Niagara or of Collamer soils. The clay concentration in the material from which Williamson soils form is mainly less than 15 percent, which appears to be an important factor contributing to the formation of a fragipan instead of a textural B like that of Collamer.

The plowed layer of Williamson silt loam is dark grayish-brown or very dark grayish-brown friable silt loam. From 8 to 18 or 24 inches is a very friable yellowish-brown silt loam or very fine sandy loam color B horizon. This horizon is typically free of mottles. From 18 or 24 to 22 or 30 inches is a light

yellowish-brown mottled horizon, which is typically more sandy than the horizon above. This rests abruptly on a firm silt loam or very fine sandy loam fragipan. Within the fragipan thick massive brown very firm silt loam layers alternate with thin layers of very fine sand that are less firm and lighter in color. These more sandy layers occur as intricately shaped bodies as well as distinct layers a few inches to a fraction of an inch thick. The darkest parts of the fragipan are highest in clay. In some profiles, lenses of brown very firm silt loam, ranging from an inch to several inches thick, are separated by very thin layers of loamy very fine sand that is appreciably lighter colored.

In this area, the soils mapped in the Williamson series have formed in a silty deposit overlying a stratified deposit of silt, clay, and very fine sand like that in which Collamer soils have formed. The silt at the surface appears to be unrelated to the stratified material below. These surface deposits range from a few inches to as much as 4 or 5 feet thick in this area; Williamson soils have been mapped where they are more than 28 inches thick, which appears to be the minimum thickness necessary for formation of the fragipan.

In much of the Williamson soil of the mapped area, the consistence and clay content of the fragipan are intermediate between those of typical fragipans of Williamson soils and textural B horizons of Collamer. In some spots, the pH increases in the fragipan and calcareous material typical of Collamer soils is present at a depth of 4 feet. In Williamson soils calcareous material would not normally be found above a depth of 6 feet. To emphasize that these soils are near the limit of the range of the Williamson series, the units have been named "weak fragipan" phases.

WiB — Williamson silt loam, weak fragipan, 2–6 percent slopes

This is the most extensive unit of the Williamson series. It is best expressed in the northern part of McGowan Woods but has been mapped from Caldwell Field to the Snyder farm. Small areas also occur from the University Golf Course eastward north of Fall Creek. Williamson is an extremely erodible soil, but throughout most of the area of this phase consistent evidence of serious erosion is lacking. Undoubtedly most of the areas have been slightly eroded. Those on Caldwell Field and those south of Dryden Road opposite Caldwell Field are moderately eroded. In these areas, the plowed layer consists largely of material from the color B.

WiC — Williamson silt loam, weak fragipan, 6–12 percent slopes, eroded

Essentially all of this phase is moderately eroded. It occupies the slopes on the north and east sides of Caldwell Field, areas around the McGowan farm buildings, and a long narrow strip across the Snyder tract. These are short slopes, but they have gradients steep enough that a significant amount of erosion has occurred. The plowed layer is principally in the former color B horizon. The amount of soil lost varies greatly from spot to spot but probably ranges from as little as 4 to as much as 12 inches.

WiD — Williamson and Amboy silt loams, 12–20 percent slopes

The Amboy component of this undifferentiated unit is the well-drained equivalent of Williamson. On slopes of this gradient in Williamson-like materials, the drainage is either good or is high in the moderately well drained range. Consequently, there is little significance in a separation between moderately well drained Williamson and well drained Amboy soils on such slopes. The areas are moderately to severely eroded. They occupy a very small aggregate acreage but are significant locally.

THE DETAILED SOIL MAP

The soil map is reproduced on an aerial photograph base. Figure 2 on page 23 is a key to the individual map pages, which are identified by letters A, B, and C from north to south and by numbers 1 and 2 from west to east. (A1, A2, B1, B2, etc.). Figure 2 is followed by the legend for the soils mapped, and the maps are the last 6 pages in the report.

To use the maps, locate the area in which you are interested on the key map of figure 2. Turn to the sheet indicated, and note the symbol of the soil of that area. Locate that symbol in the alphabetical list of symbols in the legend. The legend gives the name of the soil and the page on which it is described. Detailed information about the map unit is given on the page indicated; general information about the soil series of which the map unit is a member is given under the series heading that precedes the description of the map unit.

LITERATURE CITED

Engeln, O. D. von, 1961. THE FINGER LAKES REGION: ITS ORIGIN AND NATURE. Ithaca, Cornell University Press, 156 p.

Fairchild, H. L., 1934. CAYUGA VALLEY LAKE HISTORY. Geol. Soc. America Bull. v. 45, p. 233–280.

Merritt, R. S., and Muller, E. H., 1959. DEPTH OF LEACHING IN RELATION TO CARBONATE CONTENT OF TILL IN CENTRAL NEW YORK STATE. Amer. Jour. Science, v. 257, p. 465–480.

Soil Survey Staff, 1951. SOIL SURVEY MANUAL. UNITED STATES DEPT. AGR. HANDBOOK NO. 18. U.S. Gov't. Print. Off. 503 p.

United States Department of Agriculture, 1965. SOIL SURVEY OF TOMPKINS COUNTY, NEW YORK. United States Dept. Agr. Soil Survey Series 1961, No. 25.

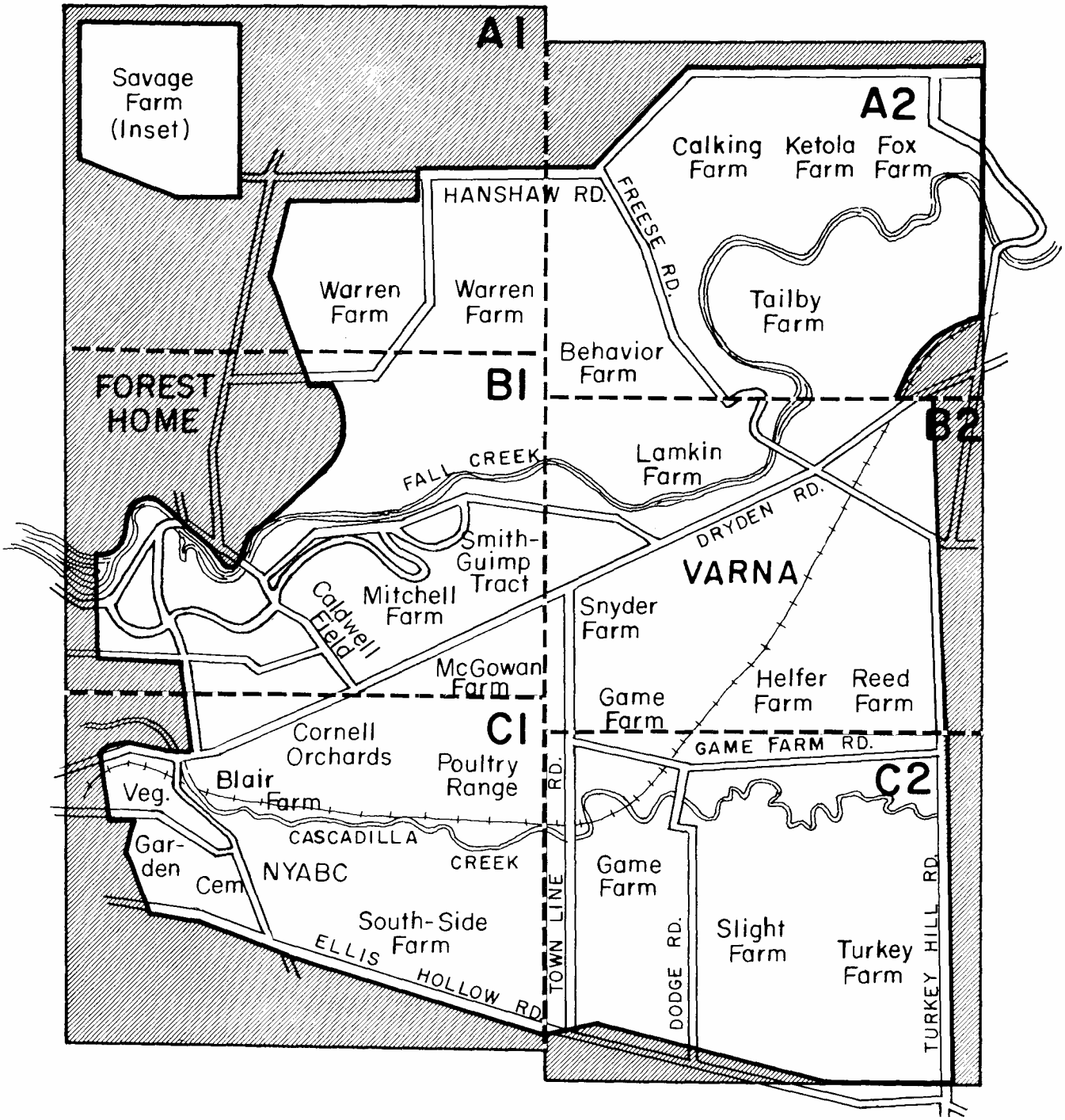


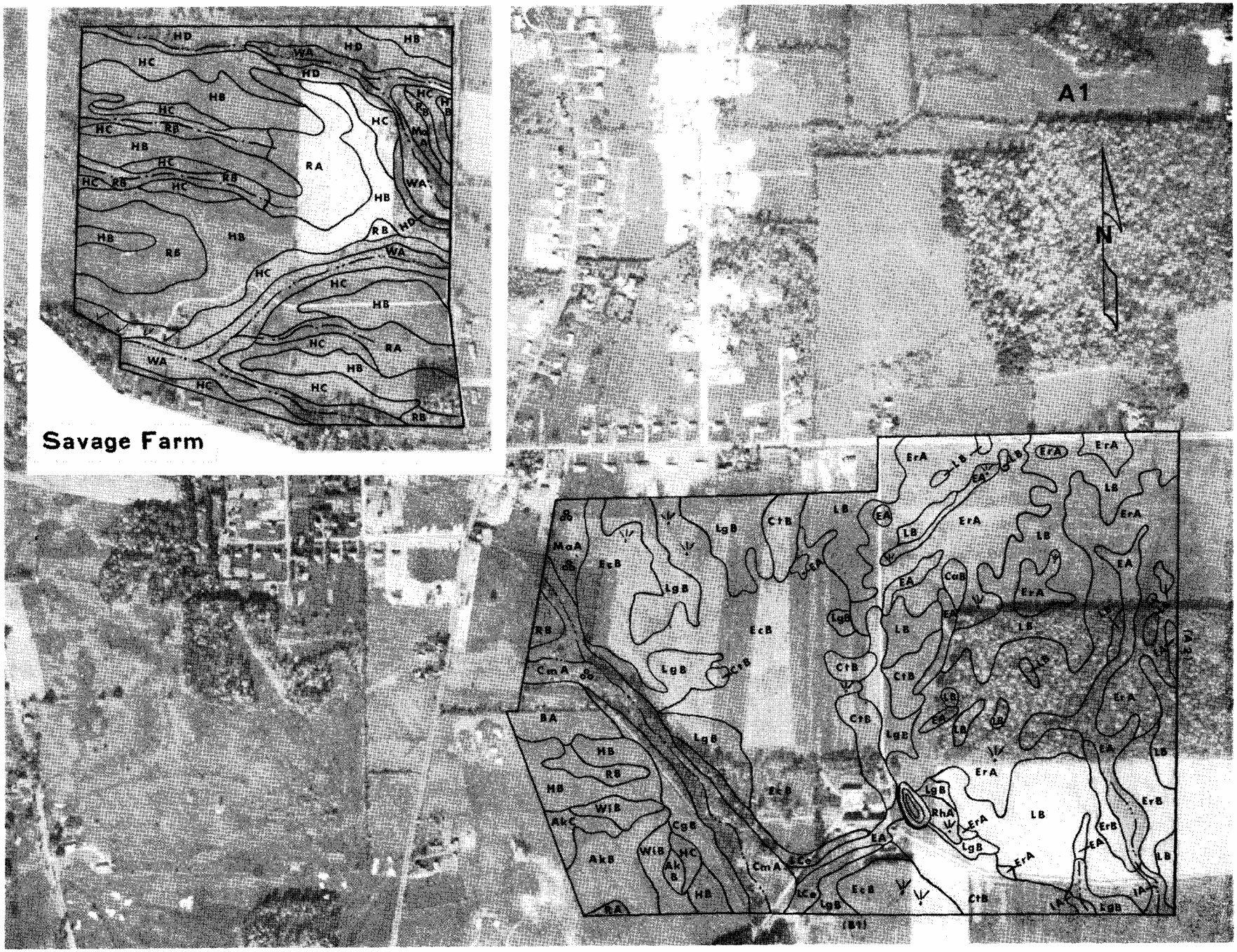
Figure 2. Index to principal Cornell properties and soil survey map sheets on which they occur.

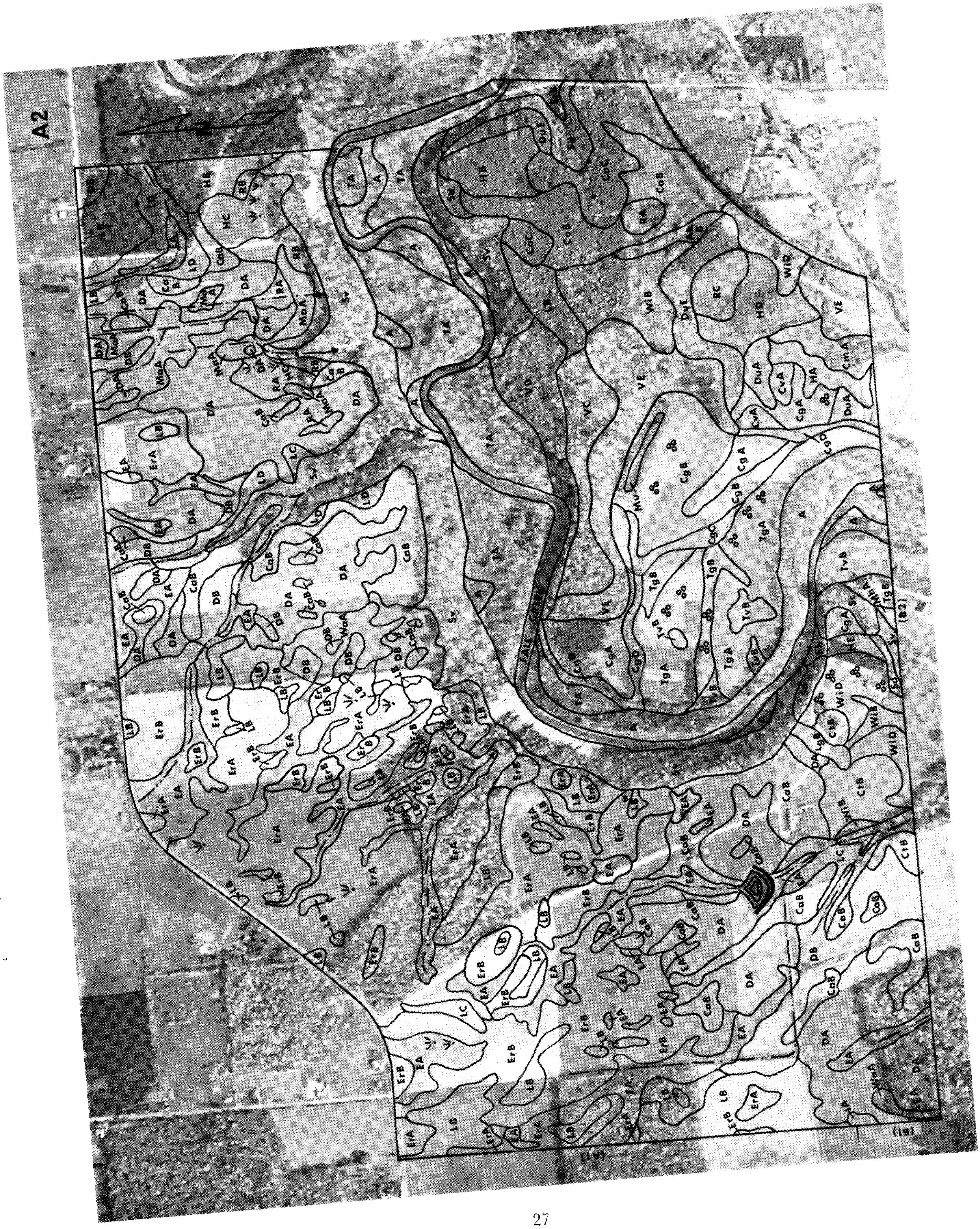
MAP LEGEND

Map symbol	*Soil Name*	*Page described*
A	Alluvial land	8
AkB	Arkport fine sandy loam, 2–6% slopes	8
AkC	Arkport fine sandy loam, 6–12% slopes, eroded	8
AkE	Arkport soils, 20–35% slopes	8
BA	Braceville gravelly loam, 0–3% slopes	9
CA	Canandaigua silt loam, 0–2% slopes	9
CmA	Canandaigua and Madalin mucky silt loams, 0–1% slopes	9
CaB	Canaseraga channery silt loam, thin mantle, 3–8% slopes	10
CgA	Chenango gravelly loam, 0–3% slopes	10
CgB	Chenango gravelly loam, 3–8% slopes	11
CgC	Chenango gravelly loam, 8–15% slopes	11
CgD	Chenango gravelly loam, 15–35% slopes	11
CtB	Chenango gravelly loam, over till, 3–10% slopes	11
CvA	Chenango very gravelly loam, 0–3% slopes	11
CoB	Collamer silt loam, 2–6% slopes	12
CoBe	Collamer silt loam, 2–6% slopes, eroded	12
CoC	Collamer silt loam, 6–12% slopes, eroded	12
DA	Dalton channery silt loam, thin mantle, 0–3% slopes	13
DB	Dalton channery silt loam, thin mantle, 3–8% slopes	13
DaB	Darien gravelly silt loam, 3–8% slopes	13
DaC	Darien gravelly silt loam, 8–15% slopes, eroded	13
DuA	Dunkirk silt loam, 0–3% slopes	13
DuD	Dunkirk silt loam, 12–20% slopes, eroded	14
DuE	Dunkirk silt loam, 20–40% slopes	14
EA	Ellery channery silt loam, 0–3% slopes	14
EcB	Erie-Ellery complex, 0–5% slopes	14
ErA	Erie channery silt loam, 0–3% slopes	15
ErB	Erie channery silt loam, 3–8% slopes	15
ErC	Erie channery silt loam, 8–15% slopes	15
ErCe	Erie channery silt loam, 8–15% slopes, eroded	15
HA	Hudson silt loam, 0–2% slopes	15
HB	Hudson silt loam, 2–6% slopes	15
HC	Hudson silty clay loam, 6–12% slopes, eroded	15
HD	Hudson silty clay loam, 12–20% slopes, eroded	16
HE	Hudson silty clay loam, 20–40% slopes	16

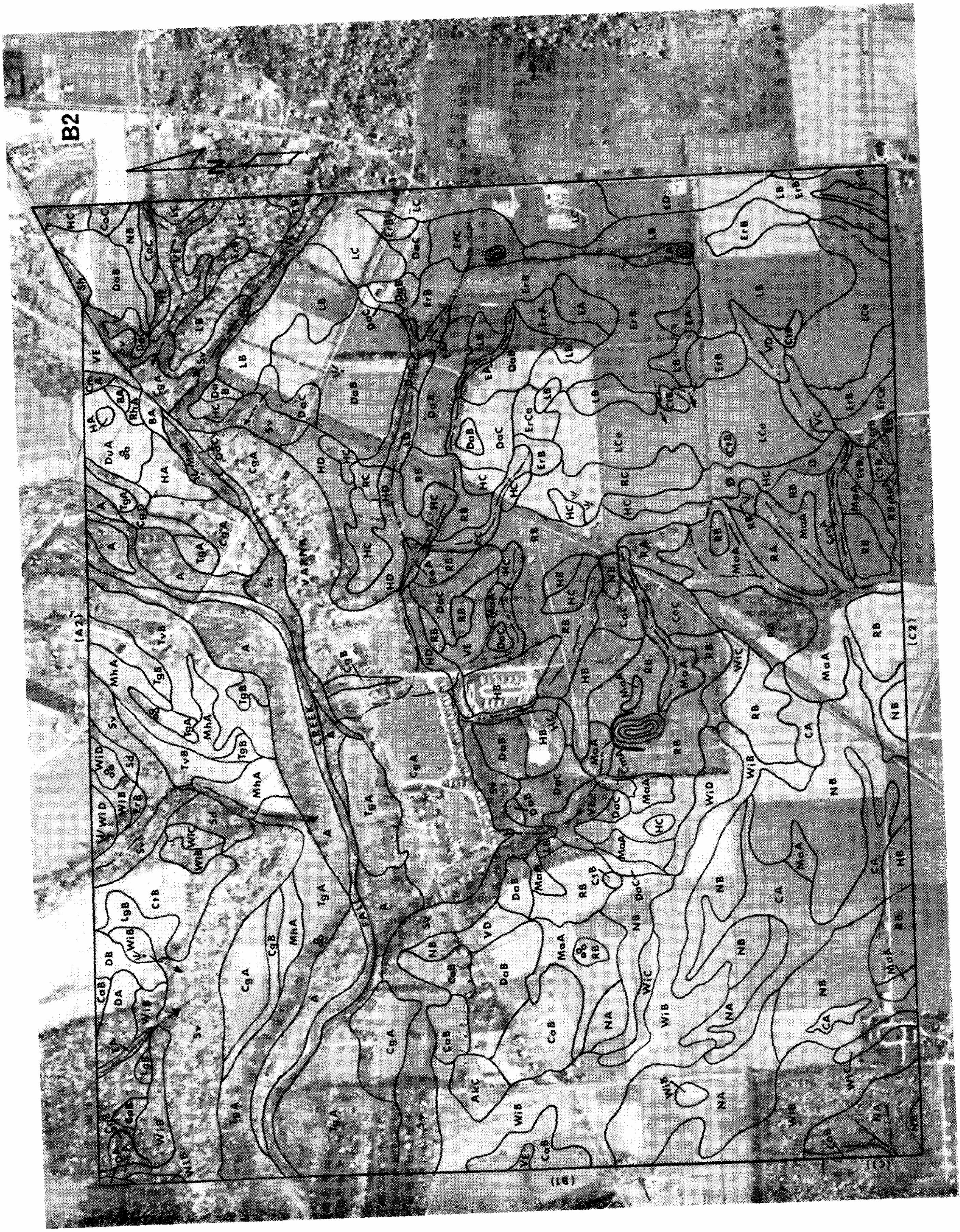
MAP LEGEND

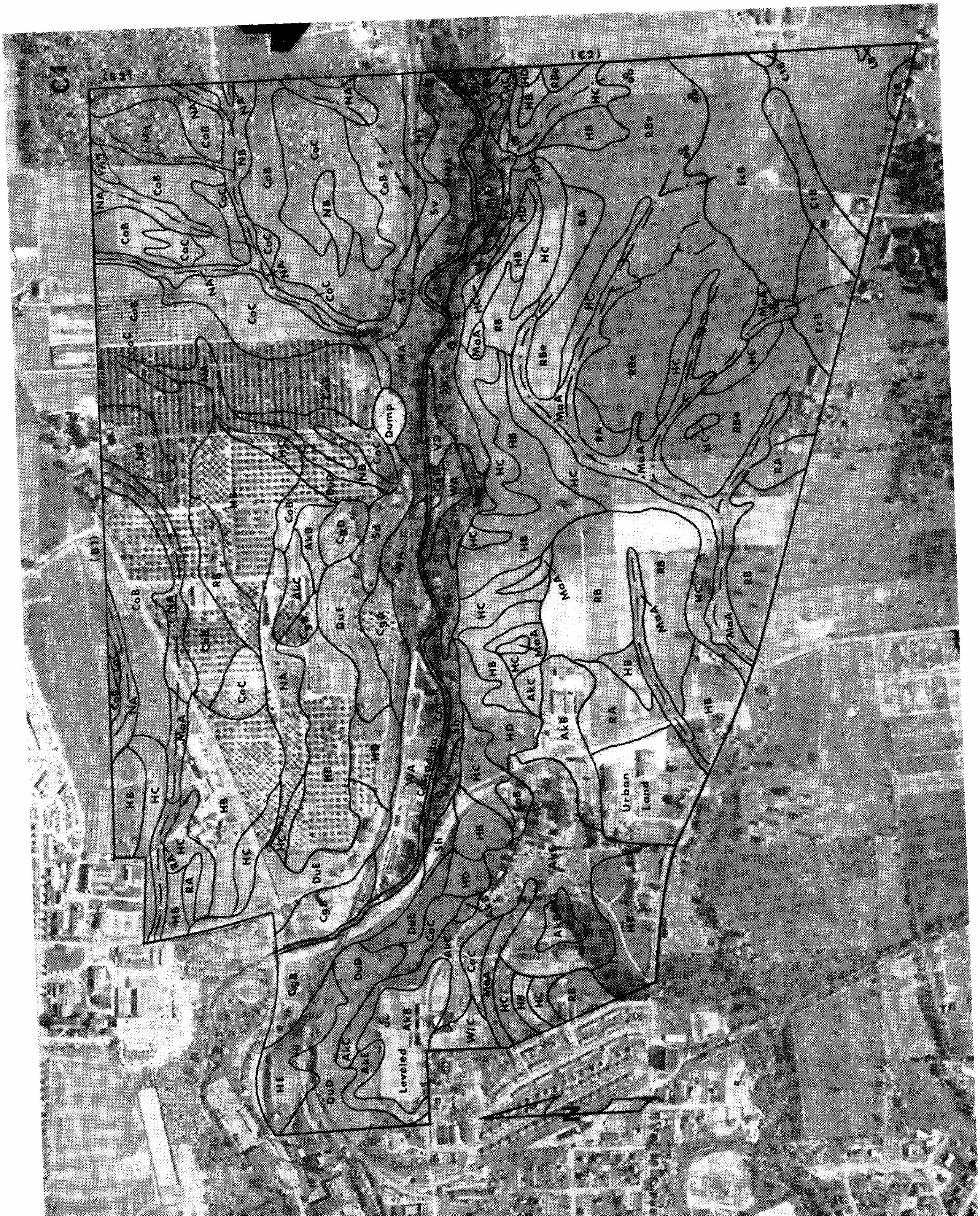
Map symbol	*Soil Name*	*Page described*
IA	Ilion gravelly silt loam, 0–3% slopes	16
LB	Langford channery silt loam, 3–8% slopes	16
LC	Langford channery silt loam, 8–15% slopes	16
LCe	Langford channery silt loam, 8–15% slopes, eroded	16
LD	Langford channery silt loam, 15–25% slopes, eroded	17
LgB	Langford gravelly loam, 2–8% slopes	17
MaA	Madalin silt loam, 0–2% slopes	17
MA	Middlebury silt loam, 0–2% slopes	17
MhA	Middlebury gravelly loam, high bottom, 0–3% slopes	17
Mu	Muck, shallow	18
NA	Niagara silt loam, 0–2% slopes	18
NB	Niagara silt loam, 2–6% slopes	18
RhA	Red Hook gravelly silt loam, 0–3% slopes	18
RA	Rhinebeck silt loam, 0–2% slopes	19
RB	Rhinebeck silt loam, 2–6% slopes	19
RBe	Rhinebeck silty clay loam, 2–6% slopes, eroded	19
RC	Rhinebeck silty clay loam, 6–12% slopes, eroded	19
RoA	Rhinebeck silty clay loam, overflowed, 0–2% slopes	19
Sc	Steep broken land, Chenango material	19
Sd	Steep broken land, Dunkirk material	19
Sh	Steep broken land, Hudson material	20
Ss	Steep broken land, shallow to bedrock	20
Sv	Steep broken land, Valois material	20
TA	Tioga silt loam, 0–3% slopes	20
TgA	Tioga gravelly loam, high bottom, 0–3% slopes	20
TgB	Tioga gravelly loam, high bottom, 3–8% slopes	20
TvB	Tioga very gravelly loam, high bottom, 1–5% slopes	20
VB	Valois channery silt loam, 3–8% slopes	21
VC	Valois channery silt loam, 8–15% slopes	21
VD	Valois channery silt loam, 15–25% slopes	21
VE	Valois and Darien soils, 25–35% slopes	21
WaA	Wallington silt loam, 0–2% slopes	21
WA	Wayland silt loam, 0–1% slopes	21
WiB	Williamson silt loam, weak fragipan, 2–6% slopes	22
WiC	Williamson silt loam, weak fragipan, 6–12% slopes, eroded	22
WiD	Williamson and Amboy silt loams, 12–20% slopes	22


Savage Farm
A1
N
HD
HB
HC
WA
RA
RB
MoA
EcB
LgB
CtB
LB
ErA
EA
CmA
BA
AkB
WfB
CgB
RhA
ErB
LCa


A2
FALL CREEK


B1
(A1)
(A2)
(B2)
N


B2
N
(A2)
(C2)
(B1)
VARNA
FALL CREEK


C1
Dump
Urban Land
Leveled

C2
N
(B2)
(C1)
Cascadilla
Creek