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SOIL SURVEY
OF
WASHINGTON COUNTY, OHIO

BY

S. W. PHILLIPS, in Charge, and H. M. SMITH, U. S. Department of Agriculture, and A. H. PASCHALL, RALPH BLANEY and GEORGE DREWES, JR., Ohio Agricultural Experiment Station

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SOIL SURVEY OF WASHINGTON COUNTY, OHIO

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COUNTY SURVEYED

Washington County is in the southeast part of Ohio. Ohio River forms the eastern and most of the southern boundary. The land area is 630 square miles or 403,200 acres.

FIGURE 1.—Sketch map showing location of Washington County, Ohio

The outstanding features in the physiography of the county are the wide river valleys and terraces of Ohio and Muskingum Rivers. West of a series of knobs on a line running north from Rockland through Tunnel and Lowell the upland consists of a dissected plateau. The ridges are flat or gently rolling, having a uniform elevation of about 940 feet above sea level. The slopes, with the exception of those along the rivers and larger creeks, are generally fairly smooth and well rounded, and the valleys are rather wide. East of the imaginary line mentioned, the slopes are generally steep or abrupt and the valleys are narrow. Here the general elevation of the ridge tops ranges from 1,000 to more than 1,200 feet above sea level, so that the horizon is irregular and lacks the uniform flatness characteristic in the western part of the county.

The slopes along some of the large streams, such as Wolf and Duck Creeks and Muskingum, Little Muskingum, and Ohio Rivers, are abrupt. Some very smooth ridge land occurs on Tick Ridge north of Beverly and between Lowell and Watertown. Probably the greatest acreage of smooth or gently rolling land in the county, with the exception of the river terraces and bottoms, occurs in the ancient river valley which extends across the county from near Browns Mill toward Barlow and Vincent. Fragments of these terraces can be identified near Fleming and Veto, at elevations ranging between 700 and 820 feet above sea level. Near Bartlett at about 900 feet, around Redbush and Little Hocking at about 700 feet, and north of Wall Street School at about 940 feet above sea level are other remnants of these old river-deposited materials.

The lowest point in the county is in the southwestern corner on Ohio River, where the elevation is 580 feet above sea level. The more important river terraces range in elevation from 620 to 680 feet. The highest elevations are in the rough, hilly section near Glass in the northeastern part, where many of the knobs are more than 1,200 feet above sea level.

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The entire county lies in the Ohio River drainage basin. Branches of the main streams ramify all parts, and every farm is connected with at least one drainage outlet. In all the county, with the exception of some small areas in the stream bottoms, surface drainage is excellent.

Washington County, the first county to be formed in Ohio, was organized in 1788 and originally included most of the eastern half of Ohio. The first settlement was made in 1788 at the present site of Marietta. The pioneers were from the New England States, and most of the men served in the Continental Army under George Washington. Later settlers came from Virginia, Pennsylvania, and other States to the east. The present population is largely descended from these early settlers, but the oil and gas industries developed during the last 40 years have attracted people from other States. The river valleys and smoother ridges in the western and central parts of the county are most thickly and the rough hilly regions in the eastern and northeastern parts are most sparsely settled. The population of the county, according to the 1920 census, was 43,049, of which 64.8 per cent was classed as rural. There has been and is now a steady drift from the rural sections. Marietta, which in 1920 had a population of 15,140, is the county seat and only city in the county. There are a number of villages and important trading places.

Railroad facilities, which are available only in the valley sections, are furnished by the Marietta branch of the Baltimore & Ohio Railroad, a branch of the Pennsylvania Railroad, and an electric line. The principal roads are hard surfaced or graveled and are maintained in excellent condition throughout the year. Several State highways and a north-and-south road from Cleveland to Jacksonville, Fla., cross the county. The secondary roads are of earth and are fair in good weather. Telephone service is available in most sections.

Marietta is the principal local market for farm produce. The principal outside markets are Pittsburgh, Pa., Parkersburg, W. Va., Cincinnati, Columbus, and Cleveland.

CLIMATE

The average annual rainfall for Washington County is 42.14 inches. The precipitation is heaviest during summer and lightest during fall. In general, winter temperature is moderate and snowfall light, and summers, with the exception of one or two hot spells of a few days duration, are comfortable. The average date of the last killing frost is April 20 and of the first is October 22, giving an average frost-free season of 185 days. The grazing season is from 8 to 9 months long. Fogs are very common along the river valleys and have considerable influence in protecting fruit trees and vegetables from frosts.

Table 1, compiled from records of the United States Weather Bureau, gives the normal monthly, seasonal, and annual temperature and precipitation at Marietta.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Marietta*

[Elevation, 627 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1904)	Total amount for the wettest year (1858)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	34.3	70	−10	3.44	2.82	8.66	4.0
January	32.0	72	−21	3.35	1.86	1.66	5.8
February	33.9	74	−22	3.17	1.82	3.41	5.0
Winter	33.4	74	−22	9.96	6.50	13.73	14.8
March	42.5	89	−2	3.47	4.35	1.00	3.3
April	53.3	93	20	3.40	2.48	5.00	.8
May	63.0	97	29	3.88	2.64	12.42	.0
Spring	52.9	97	−2	10.75	9.47	18.42	4.1
June	70.5	98	39	4.21	3.35	3.09	.0
July	74.2	104	48	4.59	3.16	5.33	.0
August	72.4	106	44	3.81	.71	7.42	.0
Summer	72.4	106	39	12.61	7.22	15.84	.0
September	65.7	94	32	3.06	1.40	1.37	.0
October	53.4	87	17	2.88	1.28	7.66	.2
November	42.9	78	10	2.88	.14	4.82	.8
Fall	54.0	94	10	8.82	2.82	13.85	1.0
Year	53.1	106	−22	42.14	26.01	61.84	19.9

AGRICULTURE

Since early settlement the agriculture of Washington County has been of a general type. Corn and small grain were grown and livestock, for which the forests afforded abundant range, raised. The farmers were self-sustaining, each producing his own foodstuffs and raw materials for clothing. The hilly relief naturally precluded the use of much of the land, and the steep slopes eroded badly after a few years in cultivation. It was common practice to clear a field, farm it until it became badly eroded, and then allow it to revert to pasture and brush. Other fields were cleared to take its place.

Tobacco was an important crop in some sections until about 1880, but practically none is grown now except in the northeastern corner of the county where the influence of the extensive tobacco culture in Monroe County is felt. This crop is usually produced on small belts of colluvial material at the base of slopes or on small stream-bottom areas. The first apple and peach orchards in Ohio are said to have been set out near Marietta. The hilly land offered excellent orchard sites with good air drainage, and by 1899 there were 448,149 apple trees and 99,427 peach trees in the county. With the extension of orchard plantings, however, diseases and insect pests became prevalent, and the number of fruit trees has been reduced more than half. The discovery of oil and gas and their development between 1880 and 1900, particularly in the eastern part of the county, resulted in the virtual abandonment of many hill farms and orchards. By 1900

the farmers along the river bottoms began to be interested in truck gardening, and dairying and poultry raising began to assume importance as sources of income on many farms. Cattle and sheep have always been important.

At the present time, agriculture in the county might be divided into two classes. First and most prevalent is general farming in which corn, wheat, and hay crops are produced and sold or fed on the farm, and second is trucking or market gardening which prevails on the terraces and alluvial lands along Ohio and Muskingum Rivers, often in combination with general farming and cattle raising. In the eastern part of the county the cultivated fields are small, and agriculture closely resembles that prevailing in mountainous sections of eastern United States.

In 1924, hay occupied the largest acreage, followed by cereal crops, vegetables, and miscellaneous crops. The value of the crops grown was $2,264,821. In the same year the value of dairy products was $553,628, of wool $92,321, of chicken eggs produced $479,496, and of chickens raised $241,865.

Table 2 gives the acreage and production of the principal crops in 1924, as reported by the 1925 agricultural census.

TABLE 2.—*Acreage and production of principal crops in 1924*

Crop	Acreage	Production	Crop	Acreage	Production
	Trees	*Bushels*		*Acres*	*Tons*
Apples	[1] 152,516	215,075		47,781	51,579
Peaches	[2] 44,032	18,834	Hay crops	674	---
			Cabbage	670	---
	Acres	*Bushels*	Sweet corn	792	---
Corn harvested for grain	20,185	623,667	Tomatoes	112	---
Wheat	10,646	136,318	Watermelons		
Oats threshed for grain	3,079	105,348			
Barley	11	275			
Rye	94	1,221			
Buckwheat	534	7,764			

[1] Bearing age. [2] All ages.

The corn and wheat grown are utilized principally for food and feed on farms where they were produced. The principal tame-hay grasses, timothy, redtop, and clover, are usually grown in mixtures. Some legumes and grains are cut green for hay, and silage and coarse forage are cut from larger acreages. Although there are many areas of hill-land pasture with an excellent bluegrass sod, much of the slope land is covered with broom sedge, poverty grass, cinquefoil, and other weeds which afford very poor pasturage. During recent years Japan clover has been appearing rather rapidly.

Vegetables and truck crops are grown principally on the terraces of Ohio and Muskingum Rivers and on the smooth upland ridges in the central and west-central parts of the county. A large proportion of the truck crops and part of the fruit crop are marketed through a cooperative association. The local shipping season continues from early in July until the middle of August. Early marketing of their products is the aim of all truck farmers, as prices usually decline sharply after the first few days of shipping. Truck grown on hill lands is usually put on the market from about three to six days later than that grown on the sandy and gravelly

terrace soils. Truck crops are produced in this county for table use rather than for canning and are of high quality.

Dairying is of considerable importance, particularly in the vicinity of Marietta. Livestock raising is carried on throughout the county, especially in the central and western parts. Purebred bulls are rapidly replacing grade animals, and the quality of the cattle is improving. Hereford and Shorthorn predominate among beef breeds and Jersey, Holstein, and Guernsey among dairy breeds. Some feeder cattle are raised locally and some are shipped in and fattened for market.

Sheep are most numerous in the western half of the county. Most of the animals are crossbred. Hogs are raised on most farms, principally for home needs. Poultry products are an important source of income to a constantly increasing number of farmers.

Since the land in Washington County was first cleared, the relief has played an important part in agriculture. The smooth land has been utilized for cultivated crops and has been intensively farmed, and the rough hilly areas have either been reserved for grazing or allowed to revert to forest. It is reported that the sandy and gravelly terraces were not held in very high esteem by early settlers. These light-textured terrace soils have been found particularly well suited to truck crops, because they warm up early in the spring and are flat. In the ridges Tilsit silt loam, owing to its favorable surface features and structure, has been found well suited to wheat and, more recently, to tomatoes, cabbage, and other truck crops. Although it is somewhat later than the terraces, this soil is said to produce an especially high quality of truck. The Upshur soils are considered well suited to hay grasses and clover and alfalfa, and in sections where these soils are prevalent livestock raising is very important. The overflowed bottom lands are recognized as being particularly well suited to corn and hay.

There is considerable variation in farming methods and equipment in use in the county. In the valleys and on smooth uplands, modern methods are employed. Machinery is used wherever possible, with a resultant reduction in man labor and increased speed in operations. Tractors are becoming numerous. In the rolling and hilly sections, lighter equipment and less machinery are used, and a smaller acreage is farmed by one man. Also buildings are smaller and the farmsteads have a less prosperous appearance. In the rough hilly sections a mountain type of agriculture is followed. The houses and buildings are small, equipment is light and inefficient, the fields are small, and much hand labor is required. In the trucking areas a very large percentage of the work is necessarily done by hand and a large equipment of machinery is not necessary. Most of the plants are grown under glass frames or in greenhouses. As the crops are marketed directly there is little need for barn space for storage. The work animals are mainly horses.

Modern equipment in the farmhouses is becoming fairly common. The abundance of natural gas in many parts of the county and the gas pipe lines that cross the county from West Virginia to Ohio cities to the west afford cheap gas to many farms for heating and lighting.

The general crop rotation followed in the county is corn, wheat, and hay, which is usually left from two to five years. The truck

gardeners grow corn rather extensively and change crops from patch to patch without much definite rotation, their aim being to maintain the supply of organic matter and prevent the accumulation of injurious insect pests and plant diseases. Tomatoes are usually followed by cabbage, and this by sweet corn. Clover, rye, and soybeans are the principal cover crops. Rye straw is also used to some extent for mats to cover the plant beds in the spring.

The 1925 census reports a fertilizer expense for 1924 of $116,610, or an average of $52.12 for the 2,226 farmers reporting its use. Superphosphate (acid phosphate) is most commonly used on general farm crops, but truck farmers use a wide variety of mixed complete fertilizers, as well as nitrate of soda, sulphate of ammonia, and potash salts, particularly on the sandy and gravelly lands.

The farm work is performed principally by the farmer and his family. Hired laborers are mainly residents of the county, many of them being small farmers who work part of the time for neighbors. The farm labor supply is very limited. The expenditure for labor reported in 1924 was $208,727, when about 37 per cent of the farmers reported the hire of labor.

The farms in Washington County range widely in size. A number contain more than 200 acres, but the average size is 84.9 acres. Many farms in the truck-garden sections range in size from 10 to 40 acres.

The 1925 census reports that 12.6 per cent of the farms of the county are operated by tenants, mainly on a share-rent basis, though some land is rented for cash for grazing and cropping.

The range in selling price of land in the county is from $1,000 an acre for good trucking land without any buildings to about $10 an acre for some of the steep hilly land in the less accessible parts of the county. The gas and oil business has a considerable bearing on land values, land in or near proved fields usually commanding higher prices. The average value of land alone in 1925 was reported as $28.85 an acre.

SOILS

In general the soils of Washington County are characterized by a lack of definite development of layers or horizons. This lack of layers in the hilly or rolling upland soils results from erosion which removes the soil before sufficient time has elapsed for layers to develop. In the terrace and bottom soils the material is of too recent deposition for the horizon-forming processes to be effective. Tilsit silt loam of the uplands, Vincent silt loam and Holston silt loam of the old terraces, and Monongahela silt loam of the recent terraces have well-defined profiles, as the material has lain on smooth areas for a considerable period of time.

Another characteristic of the soils of the county is their light color, which results from their development under forest conditions which do not encourage the accumulation of organic matter in the soil.

The typical well-developed soil profile of this county is perhaps best illustrated by that of Tilsit silt loam. In this soil silt loam extends from the surface to a depth of about 18 inches with little textural change but with slightly increasing compactness. The sur-

face soil to a depth of a few inches is somewhat darker than the lower part of the horizon, owing to the incorporation of organic matter. This layer shows a somewhat platy structure in the upper part but gradually develops a rather compact consistence and breaks into particles from one-fourth to three-eighths inch across, on the surface of which is a thin veneer of grayish material of light texture which does not penetrate the clod. This gray veneer becomes more pronounced in the more compact and heavier material below a depth of 18 inches. Numerous soft brown concretions of iron oxide are present at this depth. Below about 2 feet the material is compact and rather hard yellow or ocherous-yellow silty clay loam with perpendicular tubes or cracks between the soil particles, which in this layer range up to three-fourths inch across, filled with tough plastic gray silty clay loam. Small brown or buff irregularly shaped pockets of silty clay loam and small brown or dark-brown iron-oxide concretions may also be present.

Below a depth ranging from 32 to 36 inches, the material is less compact rather friable light silty clay loam or silt loam with a reddish cast due apparently to a thin reddish film accumulation along some of the particle faces. In most places in this layer spots of gray silty clay or silty clay loam, some brown pockets similar to those described above, and numerous soft iron concretions are to be seen. The gray material in this layer and the layer above is more noticeable than the surface material, comprising about one-fourth of the total mass. Between depths of about 40 inches and 4 feet the material is characterized by veins of gray and yellow and by dark-brown and gray veneering along the surfaces of the large particles which are from one-half to 1 inch in diameter. The soft iron concretions are less numerous and the material is decidedly less compact as well as lighter in texture than in the layer above. In deep areas this layer may extend to a depth of 6 or 7 feet, the lower part of it containing sandy streaks, bearing considerable mica flakes, and probably representing an incompletely weathered layer. The underlying bedrock occurs in most places within 7 or 8 feet of the surface.

Although the Tilsit soils have the best-developed profile in the county, they are not representative of the important soils of the county. The typical profile is approximately as follows: (1) Surface layer, about 6 inches thick, grading into (2) a slightly lighter-colored subsurface layer; (3) a slightly compact and somewhat heavier layer than that above, grading into (4) the substratum consisting of bedrock or sand and gravel.

The soils have been mapped and classified according to their characteristics of color and structure, their origin, and drainage conditions into groups called series which are further separated, on the basis of texture, into soil types. In Washington County 21 soil types and 14 phases of types, representing 14 soil series, and in addition steep broken land, a miscellaneous class of material, have been mapped.

The Muskingum soils are characterized by grayish-brown or yellow surface soils and subsoils. Bedrock of sandstone and shales lies not more than 2 or 3 feet below the surface. These soils are commonly acid in reaction. Muskingum silt loam, with a steep phase, and Muskingum loam are mapped.

The Upshur soils have dark reddish-brown or red surface soils and red or Indian-red subsoils. They are derived from red, greenish, and yellow shales and some sandstone and limestone. Like the Muskingum soils they are typically comparatively shallow, and fragments of shale and sandstone are common throughout the surface soil and subsoil. These soils are neutral or slightly acid in reaction. Upshur clay, with steep, eroded, and colluvial phases, and Upshur silty clay loam, colluvial phase, are mapped.

The Meigs series includes patches of Muskingum and Upshur soils so mixed as to be unmappable separately. The reaction ranges from acid to neutral. Meigs silty clay loam, with a steep and a smooth phase, is mapped.

The Tilsit soils are characterized by a gray or brownish-gray surface layer and a yellow friable subsurface layer, becoming compact at a depth of about 18 inches and then more friable and less compact at a depth ranging from about 30 to 36 inches. The underlying rock lies from about 4 to 8 feet below the surface. Soft dark-brown iron concretions and streaks, tubes, or veneering of gray or dark-gray material are common. The reaction is acid. Tilsit silt loam is mapped.

The Belmont series includes undifferentiated Upshur and Muskingum soils and brown limestone soils of the Brooke series. Belmont silty clay loam, with a steep phase, is mapped.

The Holston soils are characterized by brown or brownish-yellow surface layers, lighter-colored subsurface layers, and brown or yellowish-brown compact subsoils. These soils are generally somewhat acid. Holston silt loam with a high-terrace phase and Holston very fine sandy loam, high-terrace phase, are mapped.

The Monongahela soils are similar in origin and mode of deposition to the Holston soils and may be regarded as poorly drained equivalents of those soils. They resemble the Tilsit soils in profile, having grayish-brown surface soils and brownish-yellow mottled subsoils, in most places compact and containing numerous dark-brown iron concretions. Monongahela silt loam is mapped.

The Vincent series includes soils consisting of very old alluvial deposits occurring in an old abandoned river valley and closely resembling the Tilsit and Monongahela soils, but differing from them in having, at varying depths, a substratum of stratified plastic calcareous red clay. Vincent silt loam with a deep phase is mapped.

The Waynesboro soils also consist of very old alluvial deposits occurring in an old abandoned river valley. They have yellowish-brown or grayish-brown surface layers, yellow friable subsurface layers, and yellow heavier compact subsoils. Below a depth of about 2 feet is dull-red, gritty, stiff but friable clay, becoming more sandy with depth and showing streaks or layers of fine sand and rounded quartz gravel and other sandstone pebbles. Waynesboro silt loam is mapped.

The Wheeling soils are terrace soils which receive an abundance of alluvial material washed out of the glaciated regions as well as the local unglaciated uplands. The silt loam, fine sandy loam, loamy fine sand, gravelly loam with a very gravelly phase, and loam members of the series are mapped.

The Moshannon soils are reddish brown with red subsoils. They occur along streams that drain Upshur and Meigs uplands, from which they receive their characteristic color. Moshannon silt loam and Moshannon silty clay loam are mapped.

The Huntington soils are rich-brown well-drained bottom soils occurring along streams that drain uplands consisting of limestone or mixed limestone, sandstone, and shale soils. These soils are generally neutral or very slightly acid. Huntington silt loam with a high-bottom phase and Huntington fine sandy loam with a high-bottom phase are mapped.

The Lindside soils may be considered as imperfectly drained equivalents of members of the Huntington series. These soils have grayish-brown surface soils and compact grayish-brown subsoils in which are streaks or veins of dark gray and reddish yellow. Lindside silty clay loam is mapped.

The Atkins soils occur in poorly drained bottoms along streams which drain uplands consisting predominantly of sandstone and shale soils. These soils have gray surface soils and pale-yellow subsoils mottled with bluish gray and rust brown. Atkins silty clay loam is mapped.

Steep broken land is a miscellaneous class of nonagricultural land.

In the following pages of this report the soils of Washington County are described in full and their agricultural importance is discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are shown in Table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Washington County, Ohio*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Muskingum silt loam	18,368	5.3	Vincent silt loam	1,600	1.6
Steep phase	2,752		Deep phase	4,800	
Muskingum loam	1,536	.4	Waynesboro silt loam	384	.1
Upshur clay	31,232	15.8	Wheeling silt loam	2,624	.7
Steep phase	30,848		Wheeling loam	448	.1
Colluvial phase	1,536		Wheeling fine sandy loam	4,288	1.1
Eroded phase	192		Wheeling gravelly loam	1,792	.5
Upshur silty clay loam, colluvial phase	896	.2	Very gravelly phase	192	
Meigs silty clay loam	89,920	48.7	Wheeling loamy fine sand	704	.2
Steep phase	100,160		Moshannon silt loam	7,296	1.8
Smooth phase	6,336		Moshannon silty clay loam	9,664	2.4
Tilsit silt loam	13,248	3.3	Huntington silt loam	3,776	2.4
Belmont silty clay loam	2,560	.7	High-bottom phase	5,952	
Steep phase	448		Huntington fine sandy loam	832	.5
Holston silt loam	1,088	.5	High-bottom phase	1,408	
High-terrace phase	832		Lindside silty clay loam	1,408	.3
Holston very fine sandy loam, high-terrace phase	256	.1	Atkins silty clay loam	768	.2
Monongahela silt loam	3,776	.9	Steep broken land	49,280	12.2
			Total	403,200	

MUSKINGUM SILT LOAM

Muskingum silt loam has a grayish-brown or brown silt loam surface layer from 4 to 6 inches thick, grading into brownish-yellow heavy silt loam which gradually becomes heavier with depth. Below a depth of about 12 or 14 inches is slightly compacted yellow silty clay loam containing numerous small angular fragments of sandstone and shale

and some small dark-brown iron-oxide accumulations and concretions. At a depth of about 18 or 20 inches the material consists of yellow compact loam or silt loam and partly weathered sandstone, and between depths of 24 and 30 inches the practically unweathered sandstone and shale formations are reached. In wooded areas there is a thin surface accumulation of organic matter, beneath which the soil is gray or dark-gray silt loam grading into grayish-brown silt loam.

Several variations have been included with this soil in mapping. Along outcrops of sandstone ledges the soil is influenced by this material and includes areas of loam too small to be separately mapped. Similarly small areas of shale silt loam are included. In the extreme western part of the county about 2 miles northwest of Bartlett the soil is considerably deeper than typical, the partly weathered rock material lying from 34 to 36 inches below the surface. Small flakes of mica are common in the subsoil.

Muskingum silt loam occurs principally in the western part of the county, in Waterford, Wesley, Palmer, and Fairfield Townships, and in the northern part in Liberty Township. Areas are typically rolling or somewhat hilly, but some occupy fairly smooth ridge crests and gentle slopes. Drainage is well established, and, owing to the generally sloping relief, surface drainage tends to be excessive. Sheet erosion is actively removing considerable of the surface soil, exposing the heavier subsoil or even in places developing gullies which cut down to parent rock.

About 80 per cent of the Muskingum silt loam has been cleared of its forest cover of various hardwoods and some pine. It is used principally in the production of the general crops of the region and for pasture. Corn yields 30 bushels to the acre, wheat 15 or 20 bushels, and hay 1 ton. Fields which have been carefully farmed and which are not too acid or too low in available phosphorus support a good bluegrass sod for several years. The bluegrass, however, is gradually crowded out by poverty grass, broom sedge, briers, and weeds.

In general this soil is acid. Tests show a lime requirement of 2 or 3 tons to the acre, depending on the legume to be grown. Subsequent applications of 1½ or 2 tons should be made in four or six years. Lime gives profitable results. The use of superphosphate is recommended and should be more general, because this material not only stimulates the grain crops but results in improved pastures. Applications range from 200 to 300 pounds to the acre. Experiments show that lime and phosphate are the materials most needed by the soil. Barnyard manure is usually used on cornland and meadows. To prevent gullying and surface erosion, the steeper slopes should be maintained in pasture and occasionally treated with phosphorus and lime.

Muskingum silt loam commands $50 or less an acre, depending on the location.

Muskingum silt loam, steep phase.—Muskingum silt loam, steep phase, differs from the typical soil in being somewhat more shallow and in containing more rock and shale fragments throughout. It includes small areas of Muskingum loam and shale silt loam and steep broken land.

This soil occupies slopes so steep or abrupt as to be unfit for cultivated crops. It occurs most extensively near the typical soil in the northern and western parts of the county. About one-third of this land is cleared, but only a few small patches are farmed. The remainder is in timber, consisting of mixed hardwoods and some pine, with hemlock common in deep shady ravines. The cleared areas are used for pasture.

Soil of this kind can probably be best used for forestry, since its steep relief makes it of low value for pasture and the sod is normally not sufficiently heavy to prevent a very rapid removal of the soil with subsequent further depression of its value for grazing.

MUSKINGUM LOAM

Muskingum loam has a brownish-yellow loam surface layer grading at a depth of 3 or 4 inches into yellow or pale-yellow loam or light-textured loam. Below a depth ranging from 8 to 12 inches the material is light-yellow loam containing numerous angular fragments of partly weathered sandstone. In most places bedrock is reached between depths of 24 and 30 inches. In wooded areas a ¼-inch layer of dark-gray loam on the surface is underlain by light-gray loam about one-half inch in thickness, which grades into pale-yellow or grayish-yellow loam. These layers are obliterated by plowing.

This soil occurs principally on slopes and narrow ridges in the extreme western part of the county where thick sandstone formations come to the surface. Sandstone outcrops on some rather steep areas, which, if of greater extent, would have been included with steep broken land in mapping.

Muskingum loam is well drained because of its porosity and rolling or steep relief. About 50 per cent of the land is cleared of its original timber and is devoted to pasture and to a less extent to the production of the general crops of the region. Crop yields are about the same as on Muskingum silt loam.

This soil, owing to its steep relief, should probably be reserved mainly for pasture or forestry, although it has been successfully planted to orchards and berries in other places. Pastures will be found to respond profitably to applications of lime and superphosphate at the rate of about 1½ or 2 tons and 400 pounds to the acre, respectively. Raspberries, blackberries, and strawberries thrive.

UPSHUR CLAY

Upshur clay has a 5-inch dark-brown or dark reddish-brown silty clay loam or clay surface layer grading into red or Indian-red plastic clay which at a depth of about 12 inches gives way to Indian-red tough clay containing numerous partly weathered fragments of red and greenish shale. Below a depth ranging from 24 to 30 inches the shale comprises most of the material. Bedrock generally occurs from 3 to 5 feet below the surface. In wooded areas a thin surface film of organic matter is underlain by a 1-inch layer of grayish-brown silt loam rather abruptly underlain by light-red clay, clods of which break into particles about the size of a pea. At a depth

ranging from 4 to 6 inches this passes into dark-red or Indian-red clay of somewhat coarser texture.

On ridges and knobs north and northwest of Gravelbank and also in the central part of the county, particularly at elevations of about 1,000 feet, the soil is influenced by limestone ledges and bands of soil derived from limestone and in which fragments of limestone may be found. The shales from which this soil is largely derived, in exposed cuts have a heather appearance (mixed red and green) and are fairly friable. In the vicinity of the Muskingum and Meigs soils Upshur clay includes small patches which have a yellow silt loam surface soil and yellow or reddish-yellow subsoil continuous to a depth ranging from 6 to 15 inches. If such areas were larger they would be mapped as Meigs silty clay loam. Southwest of Constitution some included patches are dark-gray or brown clay, passing into yellow or brownish-yellow sticky clay beneath which is greenish-yellow and brown sticky clay. A few limestone fragments are on the soil and through the subsoil. Such areas are locally called "black limestone land."

This soil occurs principally in the central part of the county but to some extent in practically all parts. Where it is so intermixed with Muskingum silt loam that neither can be separated, the mixture is included with Meigs silty clay loam. Upshur clay is one of the most extensive upland soils in the county. It occupies hilly or steeply rolling areas but includes some narrow but smooth ridge crests which if more extensive would have been mapped as a smooth phase.

After clearing, owing to the slope of the land and the heavy texture of the subsoil, there is a very marked tendency for the soil to erode, and in many fields the dark-red subsoil is exposed. Owing to the absence of heavy sandstone layers in the strata from which the soil is derived there is a tendency for the surface to slip or slump. This, together with the rapid denudation and gullying which is characteristic of this soil, results in many areas being almost worthless. Roads are subject to slips, slumps, and landslides and in many places can not be permanently maintained. The tendency of the material to become pasty and jellylike owing to the constant pounding on a hard-surfaced road in wet weather results in many road failures. Especially thorough drainage seems to be needed. In its natural state Upshur clay produces almost impassable roads in wet or winter periods.

About 75 per cent of the Upshur clay has been cleared of its timber, which consisted principally of oaks, hickory, and maple. By far the larger part of the cleared land is used as pasture, owing in part to its steep relief and tendency to slip but also to the fact that it can be plowed only in a comparatively narrow range of moisture conditions. When too dry the plow turns up large clods that are difficult to pulverize, and when too wet the clay "balls up" under the plow and does not scour. However, when the soil is prepared under the proper moisture conditions it pulverizes readily.

The cultivated areas of Upshur clay are devoted principally to hay and corn. Clovers do well, and the usual hay crops consist of timothy and clover or clover alone. Yields of 1½ or 2 tons to the acre are reported. Several fields of alfalfa are on this soil, which is

well suited to this crop. Sweetclover is common along road cuts. Corn does well if the season is favorable, yields ranging up to about 50 bushels to the acre. Wheat winterkills rather badly.

Most of this soil is maintained in permanent pasture. It is commonly neutral or only slightly acid. When phosphorus is supplied, bluegrass, the various clovers, and legumes do well on it. A rather large percentage of the cattle and sheep in the county are kept on this kind of soil. Considerable dairying is carried on, and dairymen as well as cattle and sheep growers prefer Upshur clay for their pastures.

Fertilizer is generally used on corn, about 200 pounds to the acre of superphosphate being the usual application. Superphosphate is also used in preparing land for alfalfa.

As is generally recognized by farmers, this soil is best suited to pasture and hay. On permanent pastures an application of about 400 pounds of superphosphate to the acre every two or three years will produce a heavier and better stand of grass, which will enable the land to be more heavily grazed. This treatment is proving its value in a number of places in the county. The use of lime on permanent pastures can also be recommended, where the soil is acid, although it may not produce results so readily apparent as the superphosphate.

The selling price of this soil may be more than $60 an acre, depending on the location and value of associated soils.

Upshur clay, steep phase.—Upshur clay, steep phase, is characterized by slopes too steep and rough for cultivation and is best suited to forestry and grazing. In general, the soil is shallower than typical Upshur clay, and much of it is badly eroded and cut by gullies. Some included rough areas and rock outcrops are really steep broken land.

This soil supports an excellent growth of hardwoods and cedar. About one-fourth of it has been cleared and is used for pasture. The fields are steep and most of them are badly slumped, and the pasture value is lower than that of the typical soil. Along Whipple Run this soil is influenced to some extent by limestone outcrops.

Upshur clay, steep phase, is most extensive in the central part of the county in Fearing, Salem, Adams, Aurelius, Belpre, and Dunham Townships. It occupies a rather large proportion of the steep hills overlooking Ohio River.

Upshur clay, colluvial phase.—The colluvial phase of Upshur clay is rather variable, owing to its formation from Upshur materials that have rolled, washed, slid, or slumped from higher elevations. It contains numerous sandstone and shale fragments of various sizes. The texture ranges from silt loam to clay.

This phase of Upshur clay occurs principally along the lower slopes of the Muskingum and Ohio River Valleys but is also scattered through the region where the Upshur soils occur. Along the river road near the mouth of March Run it includes some small remnants of terraces. The soil is devoted to general crops, principally hay and corn, although a few patches of truck are grown. A number of farmhouses are built on this soil where it overlooks the river bottom but is not subject to overflow during flood times.

This phase of Upshur clay is somewhat more productive than the typical soil, as it commonly contains more organic matter and is constantly receiving additions of soil from higher slopes. Several excellent patches of alfalfa were seen on it during the progress of this survey.

Upshur clay, eroded phase.—Upshur clay, eroded phase, as its name indicates, includes those areas of Upshur clay that have become so badly gullied or eroded as to be rendered practically worthless for agriculture. The soil has been removed so that possibilities of reclaiming it are practically negligible. The only apparent way to handle this sort of land seems to be to allow it to revert to forest, hastening this process by planting trees. This class of land is not extensive in Washington County, but numerous patches of it have been mapped in the region where the Upshur soils predominate. It is very probable that it will greatly increase in area unless care is taken to prevent erosion on the steep hillsides.

UPSHUR SILTY CLAY LOAM, COLLUVIAL PHASE

Upshur silty clay loam, colluvial phase, consists of material that has been brought down from the near-by hills by the run-off of rainfall. It consists of Indian-red or reddish-brown silty clay loam or clay containing numerous angular fragments of sandstone and shale. There is little difference between the surface soil and subsoil, although the surface 4 or 5 inch layer may be slightly darker colored, owing to an accumulation of organic matter. As mapped, patches of loam and clay loam and of some Moshannon soils are included.

This soil occurs in fans or tongues extending from the mouth of gullies or steep ravines. It commonly occupies slightly higher land than the adjoining bottoms, as it usually receives increments of material at a more rapid rate than the bottoms. It is well drained and much of it is used for farm home sites. It is practically all utilized for general crops. Yields are about the same as on Moshannon silty clay loam. It supports an excellent bluegrass sod, and clover and alfalfa do well on it.

The value of this kind of land depends partly on its location and partly on the character of the associated soils.

MEIGS SILTY CLAY LOAM

Meigs silty clay loam consists of undifferentiated Muskingum and Upshur soils. Cultivated fields present a patchy or spotted appearance, owing to the exposure of red Upshur clay in fields consisting largely of Muskingum silt loam or of patches of Muskingum silt loam in fields consisting largely of Upshur clay or Upshur silty clay loam, colluvial phase. In some places slopes consisting of Meigs silty clay loam show a succession of alternating red and yellow streaks resulting from the outcropping of the red shales or gray sandstone and shales. Slumps and landslides are factors affecting the mixed character of the soil. The proportion of the Upshur and Muskingum soils present differs considerably, the Upshur being more prominent in the eastern part of the county and the Muskingum dominant in the western part.

The texture of the soil classified as Meigs silty clay loam ranges from silt loam or loam to clay, owing to the diversity of the materials from which the various patches of soil are derived. On smooth ridge tops and in saddles between knobs, areas have an unusually deeply weathered surface soil. Such areas commonly have a yellow surface layer, a compact yellowish-brown or brownish-yellow subsurface layer that passes into red clay, and a substratum consisting of the typical red and greenish shales characteristic of the Upshur soils. On terracelike benches overlooking the bottoms along East Branch Little Hocking River the material to a depth ranging from 1 foot to about 30 inches closely resembles that of the Holston soils or of Monongahela silt loam, but it is underlain by red clay and here and there on gentle slopes the red material outcrops. Such areas have been included with Meigs silty clay loam in mapping. Other included areas of somewhat similar appearance occur in ridges southeast of Waterford where the material closely resembles Tilsit silt loam to a depth of about 2 feet but passes down into red clay. In the northern part of the county near Elba and Macksburg Meigs silty clay loam includes a few patches of limestone soils and some limestone outcrop. At the base of many slopes there is an accumulation of colluvial material carried down by run-off or by gravity from higher slopes. Such material is variable in texture and color from silt loam to clay and from red to yellow.

Meigs silty clay loam occurs most extensively through the central and western parts of the county but is scattered through the eastern part where it occupies ridge crests and the smoother slopes. Typical areas are rolling or hilly. About 75 per cent of the soil has been cleared, and about 35 per cent is cultivated to general crops. Crop yields are about the same as on Muskingum silt loam, but in pastures the grass cover is somewhat better than on that soil. A number of apple orchards have been planted on this soil, which growers consider desirable for fruit.

Farming methods are similar to those used on the Muskingum soils. The variability of this soil, however, renders it more difficult to handle than those soils. Where the Upshur material predominates heavier equipment is needed and the soil can be worked only during a comparatively narrow range of moisture conditions. Fertilizers are commonly used, superphosphate being most widely applied. Some lime is used.

Land of this kind has a current selling price ranging from about $30 to $75 an acre.

As erosion follows plowing of the steeper slopes, such slopes should be maintained in grass as much of the time as possible. Lime will prove particularly profitable on the light-colored areas, and lime and superphosphate will produce an excellent bluegrass and clover sod on permanent pastures.

Meigs silty clay loam, steep phase.—The steep phase of Meigs silty clay loam differs from the typical soil principally in relief. Most of it is too steep to be used for farming. It includes some rock outcrops and precipitous slopes which if of larger extent would have been mapped as steep broken land. North of Lowell the lower slopes for a distance of 100 or 200 feet are influenced to some extent by limestone but are too steep to farm.

This soil occurs most extensively in the eastern and northern parts of the county where it occupies a very large proportion of the total area. About half of it has been cleared, and a rather large proportion has at one time or another been farmed. At present, however, probably less than 20 per cent is farmed. The remainder of the cleared land is used for pasture or is practically abandoned and is being allowed to revert to forest. The development of the gas and oil industry in the eastern part of the county resulted in the abandonment of much of this soil, which is held by oil companies and not farmed.

This kind of land can probably be best utilized for pasture or forestry. Some of it, particularly the narrow ridges and upper slopes, might be utilized for apple orchards.

Meigs silty clay loam, smooth phase.—The smooth phase of Meigs silty clay loam is deeper than the typical soil, owing to the smoother relief of the areas. It occupies rather broad rolling ridges and smooth slopes and is practically all farmed. It is mapped on the ridges between Marietta and Watertown, west of Fleming, and in Wesley, Decatur, and Fairfield Townships in the western part of the county. It is used principally for the general crops, though some patches of truck crops are grown on the lighter-colored areas between Marietta and Watertown. The smooth relief allows the use of machinery.

Wheat yields from 15 to 20 bushels to the acre, corn about 35 bushels, and hay about 1½ or 2 tons. Superphosphate is almost universally used on the wheat and by many farmers on corn. Lime is also used to some extent. Excellent tomatoes are being produced by truck farmers.

The selling price of this phase of Meigs silty clay loam is considerably higher than that of the typical soil, some areas commanding $75 an acre.

TILSIT SILT LOAM

Tilsit silt loam has a surface layer of brownish-gray or grayish-brown silt loam from 6 to 8 inches thick, passing into yellow compact but friable heavy silt loam or silty clay loam. Below a depth of about 14 inches is compact but friable brownish-yellow heavy silt loam or silty clay loam showing some gray along cracks or seams in the mass and containing numerous soft dark-brown or almost black iron concretions. At a depth of 22 or 24 inches this grades into compact yellow silty clay loam which has perpendicular tubes or streaks of grayish rather compact and plastic silty clay. Along cracks or fractures of the soil mass is a thin veneer of gray silty clay loam. There are also present some small irregular-shaped accumulations of brown or grayish-brown silty clay loam and numerous small dark iron concretions.

Below a depth of 32 or 34 inches the material is hard, compact but friable brown heavy silt loam or silty clay loam with a slight reddish cast caused apparently by a reddish film that accumulates along some of the cracks and fracture planes. Numerous small dark-brown iron concretions are present. The layer is marked by numerous tubes or dikes of gray silty clay as well as by brown material similar to that described. The gray material makes up about 20 or 25 per cent of

the total mass. Below a depth of 44 inches the material is somewhat variable, consisting of yellowish-brown and yellow silty clay loam with veins of gray silty clay or silty clay loam and pockets of brown silt loam. Along the surface of the small aggregates into which the material breaks when crushed is a thin veneer of reddish brown, dark brown, black, or gray. Soft iron concretions are less numerous than in the layer above. With depth, some veins of ocherous or rust-brown silty clay loam occur. Fine flakes of mica are noticeable along fracture lines. When broken across, the gray silty clay found in the veins or tubes shows what appears to be horizontal stratifications. The mica imparts a greasy feel to the silty clay when rubbed between the fingers.

Below a depth of 80 or 84 inches is a succession of layers of yellowish-brown compact fine sand or fine sandy loam and dark-gray or light-gray silty clay. Along the horizontal cleavage planes of these layers there are thin films of black or dark-brown material, probably an oxide of iron. This material is probably partly weathered parent rock, although no recognizable rock fragments were noticed. This passes rather abruptly into the parent sandstone at a depth of about 90 inches. The depth to bedrock is variable, in many places being only about 40 inches. In such places the subsoil between depths of 26 and about 36 inches is brown or slightly reddish-brown hard compact silt loam or very fine sandy loam or layers of both, with veins of grayish-brown silty clay and very thin films or veneers of light gray along the cleavage part of the soil particles. This layer contains some small partly weathered sandstone fragments. The material becomes more sandy as the parent material is approached.

Tilsit silt loam occurs principally in the western half of the county. It is developed on Tick Ridge north of Beverly and in the section of the county south of Muskingum River in Waterford, Watertown, Adams, Palmer, Decatur, Belpre, and Dunham Townships, and occurs to some extent in Warren, Muskingum, and Fearing Townships. Widely scattered areas are also mapped in the eastern and western parts of the county.

This soil occupies flat, gently undulating, or sloping areas, flat-topped ridges, or flat shoulders or saddles. A very flat sky line is typically presented in Waterford Township and the townships to the south, where this soil is best developed. It is associated with both the Muskingum and Upshur soils. Near Fillmore, Decaturville, and Little Hocking it is mapped on what appears to be old terrace levels, but no water-deposited materials were detected beneath the soil. Surface drainage is commonly fairly well established, but internal movement of water is impeded somewhat by the compactness of the subsoil.

Tilsit silt loam is a very important agricultural soil. Its smooth surface, as compared with the other upland soils which are rolling or hilly, makes the use of all kinds of farm machinery possible. About 90 per cent of the soil is farmed, the remainder being in hardwood forest, mainly in small wood lots. It is devoted principally to general farming, though in recent years it is being used for truck crops, including tomatoes and cabbage. Probably 90 per cent of the truck crops grown in the uplands of Washington County are pro-

duced on Tilsit silt loam. It is claimed that truck produced on this soil is superior in quality but as a rule is somewhat later in ripening than on the river terraces. A dry season is reported to prove less injurious than on the lighter-textured bottom and terrace soils with their gravelly substrata. Dairying is of some importance near Marietta.

Corn yields from 40 to 60 bushels to the acre, wheat from 15 to 25 bushels, hay, usually mixed timothy and clover, from 1 to 1½ tons, and potatoes about 125 bushels. However, constant cropping with little return of plant food to the soil reduced the productivity so greatly and the soil began to erode so badly that the growing of wheat was almost abandoned. That crop is now grown by many farmers simply as a nurse crop for clover and as a source of straw. Some soybeans are grown for hay.

The current selling price of land of this kind ranges from about $75 an acre to more than $100, depending on location and the acreage of smooth land on the farm.

To neutralize the acidity of this soil lime, at the rate of 1½ or 2 tons about every four years, should be used. Wheat and corn respond to liberal applications of superphosphate, and treatment with lime and superphosphate greatly improves the stand of grass. Unless limed, pastures revert to poverty grass, broom sedge, wild carrot, dewberries, and a scattered growth of weeds. Tile drainage, particularly on the flattest areas, would prove beneficial and would make it possible to work the land earlier in the spring. For truck crops a complete fertilizer is recommended where manure is lacking and superphosphate where an abundance of manure is available. Potash will probably give profitable returns. Rotation of crops and the growing of truck crops for only one year will greatly aid in control of insect pests and plant diseases.

BELMONT SILTY CLAY LOAM

Belmont silty clay loam consists of undifferentiated Upshur, Muskingum, and Brooke soils. The last-mentioned are brown clay grading into yellow or brownish-yellow clay and are derived from limestone. This soil type is closely associated with the Meigs and Upshur soils and includes areas of both that could not be mapped separately on the scale used. In many places it was necessary to draw arbitrary boundaries between these soils. Belmont silty clay loam can be considered as a mixture of soils resembling Meigs silty clay loam but including recognizable areas of soil that owe their origin to limestone. Fragments of limestone are present on slopes. In other places included areas might be likened to a limestone phase of Upshur clay.

This soil occurs principally in the northern part of the county in Aurelius and Salem Townships. Other areas are mapped in the extreme northwestern part along Wolf and Olive Green Creeks. Areas typically are hilly or steeply rolling, but some narrow ridges are included. Drainage is well established, and owing to the steepness of the relief there is a strong tendency for the soil to erode.

About 75 per cent of this soil is cleared and approximately one-half of the cleared land is farmed, mainly to corn and hay though some wheat is grown for establishing a stand of grass. Wheat win-

terkills badly. Alfalfa and clover do very well. About one-half of the soil is maintained in more or less permanent pasture, being plowed up occasionally. It supports an excellent stand of bluegrass. Several orchards have been planted. Corn yields from 40 to 60 bushels to the acre and hay from 1½ to 2 tons. Alfalfa is cut several times, yielding 4 or 5 tons to the acre in a season.

This soil is sometimes plowed during winter to allow freezing and thawing to improve the tilth. Like Upshur clay most of it can be farmed only in a narrow range of moisture conditions. In dry periods the soil cracks badly and is cultivated with difficulty. As a rule little fertilizer is used, most farmers depending almost entirely on manure for maintaining the fertility. Sheep and cattle are extensively grazed. Alfalfa land should be given an application of 300 or 400 pounds of superphosphate to the acre. Lime is rarely needed, as the soil is seldom acid.

Land of this kind usually is held at prices ranging from $40 to $60 an acre.

As this soil is particularly well suited to grass, cattle and sheep raising are popular on it. Permanent pasture could be improved by an occasional application of lime and superphosphate.

Belmont silty clay loam, steep phase.—The steep phase of Belmont silty clay loam differs from the typical soil in that it is too steep for cultivated crops. It occurs in the same localities as the typical soil, occupying steep slopes and in some places including patches so abrupt and broken that they would have been mapped as steep broken land had a map of larger scale been used.

About one-third of this soil is cleared and affords good pasturage; the remainder is in hardwood forest. Grazing and forestry are the uses to which it is best suited.

HOLSTON SILT LOAM

Holston silt loam to a depth of about 6 inches consists of brownish-yellow or yellowish-brown silt loam. This grades into brown or yellowish-brown somewhat compact silt loam. Below a depth ranging from 16 to 20 inches the material is compact brown silty clay loam streaked with ocherous yellow, and below 26 inches is brown silty clay showing some gray veneering along the seams or cracks and some ocherous-yellow streaks, rust-brown or black iron stains or films along cracks, and black or dark-brown iron-oxide concretions. Below a depth ranging from 46 to 50 inches is gray, brown, yellowish-brown, and rust-brown friable silty clay loam containing some very fine sand. The gray and rust brown occur as a film along cracks or breakage planes. Below a depth of 56 inches the underlying rock or partly weathered rock is reached in most places, although in places the superficial material is only from 30 to 36 inches thick. A few patches of loamy texture have been included in mapping. Very commonly distinctly stratified layers of partly rounded sandstone gravel and sandy loam occur under this soil.

Holston silt loam occurs in small flat or gently undulating areas on high bottoms or terraces along streams that no longer overflow, principally at bends of streams or at points of juncture of two streams. It is mapped along Little Muskingum River, Duck Creek,

Wolf Creek, and other streams of the county. It occurs along streams that drain and receive practically all their waters from uplands consisting of sandstone and shales with little or no limestone influence.

Owing to the small total area of this soil it is not of very great importance agriculturally. Much of it, however, occurs in hilly sections where, owing to the very small area of tillable land, it is of local importance. All the soil has been cleared and is being farmed, principally to general farm crops. Wheat yields about 16 or 18 bushels to the acre, corn from 35 to 45 bushels, and hay about 1½ tons. Mixed timothy and clover constitute the most common hay crop. Some trucking is done near Waterford. Superphosphate is generally applied on the wheat. This soil is handled much as are Tilsit silt loam and Muskingum silt loam.

Land values range from about $60 to $100 an acre.

This soil is generally acid, according to tests made during the progress of this survey. Indicated lime needs are 1 or 1½ tons of ground limestone to the acre. More efficient underdrainage would benefit the soil. It is well suited to truck crops, and alfalfa will do well if the soil is limed and fertilized.

Holston silt loam, high-terrace phase.—The high-terrace phase of Holston silt loam has a yellowish-brown or grayish-brown silt loam surface layer about 6 inches thick underlain by a yellow or brownish-yellow silt loam layer which at a depth of 12 or 14 inches grades into friable silty clay loam. Below about 18 or 20 inches is yellow friable silty clay or heavy silty clay loam becoming somewhat sandy and very friable with depth. At a depth of about 5 or 6 feet this passes into yellow very friable fine sandy loam or loamy fine sand which continues, mixed to varying extent with stratified layers of silt and sand, to a depth of about 15 feet where stratified water-laid clay is reached.

This soil occurs in the western part of the county where remnants of old water levels occur at elevations between 100 and 300 feet above the present level of Ohio and Muskingum Rivers. Several large areas are near Bartlett, at Redbush, northwest of Vincent, north of Barlow, near Browns Mill, and about 1 mile south of Equity. In several places, particularly north of Barlow and northwest of Vincent, molding sand was at one time mined from the underlying fine sand deposits. Most of the soil has been cleared, although near the abandoned sand pits and in a few other places areas are wooded.

Locally this soil is of considerable agricultural importance. Areas are smooth, and machinery can be used. Drainage is good. General crops are commonly grown, with yields similar to those on Tilsit silt loam. The soil is used to a small extent for trucking.

This soil is somewhat acid, and lime would prove beneficial. The excellent drainage and ease of tillage should make areas valuable for truck crops, particularly with the opening up of new roads to facilitate hauling to shipping points.

HOLSTON VERY FINE SANDY LOAM, HIGH-TERRACE PHASE

Holston very fine sandy loam, high-terrace phase, has a grayish-brown or yellowish-brown very fine sandy loam or loamy very fine sand surface layer grading at a depth of about 6 inches into brown-

ish-yellow very fine sandy loam which, at a depth of about 15 inches, gives way to compact yellowish-brown very fine sandy loam. Below 36 inches the material is yellow or brownish-yellow very friable and open very fine sandy loam which gradually assumes a greenish cast with depth. This is underlain at a depth of about 50 inches by yellowish more or less stratified loamy sand. Distinctly laminated stratified clay occurs at a depth of about 25 feet.

This soil occurs only in the western part of the county, the largest area being near Bartlett. Areas are undulating or gently rolling, and drainage is good. All the soil is cleared and farmed, principally to general crops but to a small extent to truck crops. A few berry patches have been set out. Though not extensive the soil is locally important, owing to its favorable relief and ease of tillage. It is handled much as are the light-colored upland soils. Crop yields are about the same as on the Muskingum soils.

Tests show this soil to have a lime requirement of about 2 tons to the acre. Truck crops, berries, and fruit would yield greater profits than general farm crops.

MONONGAHELA SILT LOAM

Monongahela silt loam has a surface layer of grayish-brown or brownish-gray silt loam about 5 inches thick passing into brownish-yellow, gray, and rust-brown compact silty clay loam in which the gray is not very prominent and the rust brown occurs as a film along cracks or as concretions. Below a depth of about 10 or 12 inches is yellow, brown, gray, and rust-brown very compact silty clay loam, containing considerably more gray and rust brown than the layer above. The gray becomes more prominent at a depth of 20 or 24 inches and the material is compact but friable silty clay loam. Partly rounded and subangular fragments of sandstone and shale and thin layers of such material mixed with some sand occur in many places below a depth ranging from 30 to 36 inches. On the whole this soil closely resembles Tilsit silt loam and Vincent silt loam.

Several small patches of Tyler silt loam having gray or grayish-brown surface soils and gray and yellow mottled subsoils were included in mapping. One such area is about three-fourths mile south of Corner and another about one-fourth mile north of Gravelbank. Where the Muskingum uplands rise abruptly from areas of Monongahela silt loam, small accumulations of colluvial material are included in mapping.

Monongahela silt loam is mapped on higher bottoms or terraces no longer subject to overflow, along streams which drain uplands consisting of sandstone and shales. It occurs principally at bends along Little Muskingum and Little Hocking Rivers and Duck and Wolf Creeks and some of their tributaries. Areas are flat or gently undulating, and, owing to the compactness of the subsoil, drainage is somewhat imperfect.

All this soil is cleared and farmed. Although not extensive, it is important locally on account of its favorable relief. General crops are grown. Corn yields from 30 to 40 bushels, wheat about 15 bushels, and mixed timothy and clover hay about 1½ tons to the acre. Some truck crops are grown. This soil is handled much as are

other silt loam soils of the county. Superphosphate is used to some extent, principally on small grains. Lime has not as yet come into universal use on account of the expense.

Land of this kind ranges in value from $60 to about $100 an acre, depending on the location.

Underdrainage, through the use of tile, has proved very beneficial on this soil, rendering it better suited to all crops. About 2 or 3 tons of crushed limestone to the acre should be applied every four or five years. Alfalfa can be grown after the soil has been drained, limed, and fertilized.

VINCENT SILT LOAM

Vincent silt loam is brown or yellowish-brown silt loam to a depth of 4 or 5 inches. This grades into brownish-yellow silty clay loam which in turn, at a depth of about 15 inches, gives way to yellow or reddish-yellow silty clay loam or silty clay containing some black or dark-brown iron concretions and a little film of gray along the cracks in places. Below a depth of 28 or 30 inches the subsoil is calcareous red or dark-red plastic statified clay, containing numerous small irregular-shaped calcareous concretions. In places the depth to the red clay subsoil ranges from about 20 to 24 inches and in others from 36 to 40 inches. On slopes the red clay lies within 12 or 15 inches of the surface. Near areas of Upshur and Muskingum soils the boundaries are in places arbitrary.

This soil occurs in the old abandoned valley in the west-central part of the county between Browns Mill and Barlow and near Fleming. It is of alluvial origin somewhat obscured by erosion. Areas are gently undulating or sloping and are uniformly well drained.

Though of small extent this soil is important locally. All of it is cleared and under cultivation, principally to general farm crops. The smooth relief lends itself well to the use of power machinery. Corn yields from 35 to 50 bushels, wheat from 15 to 25 bushels, and hay 1½ or 2 tons to the acre. A few patches have been set to truck crops, particularly tomatoes, with very satisfactory results. Alfalfa and clovers do very well.

Superphosphate is commonly used on small grains, and some lime is used.

Land of this kind ranges in price from about $100 to $125 an acre. It is regarded as one of the best soils in the county outside of the river and stream bottoms.

Vincent silt loam, deep phase.—Vincent silt loam, deep phase, differs from the typical soil principally in that the red plastic laminated clay occurs at a depth of 4 or 5 feet below the surface. The surface layer of yellowish-brown or grayish-brown silt loam about 5 inches thick grades into brownish-yellow or yellowish friable silty clay loam. This, at a depth of about 20 inches, gives way to rather compact yellow silty clay or silty clay loam showing more or less gray veneering along the cracks of the material and containing some small rust-brown iron concretions. Below a depth of 30 inches the material is grayish-brown or yellow compact tough clay showing distinct lamination or stratification and breaking into blocks. At a depth between 44 and 50 inches this clay assumes a

reddish or pinkish cast and grades into the typical red or Indian-red plastic laminated clay. Small irregular-shaped lime nodules are numerous in these clay layers.

Near Veto in an included area the plastic laminated clay is not present, the soil being underlain by interbedded red fine sandy loam and gray plastic clay containing more or less reddish-brown or dark-brown iron concretionary material. About one-half or 1 mile west of Barlow some included areas have a light-brown surface soil grading into pale-yellow silt loam which in turn gives way to yellow silty clay loam at a depth of about 8 inches. Between depths of 12 and from 30 to 36 inches is yellow, plastic, water-laid clay containing stains and flattish concretions of lime. This is underlain by layers of yellow or grayish very fine sandy loam, silt loam, very fine sand, and clay. About 1 mile southwest of Vincent the underlying reddish loamy sand or sandy loam was formerly mined in places for molding sand.

This phase of soil occurs in the same localities as the typical soil and in similar positions. It has the same adaptations but shows a greater need for lime. All the soil is cleared and farmed. About 1 or 2 tons of limestone to the acre used once with each rotation proves beneficial. The soil is well suited to wheat, hay, and truck crops and on account of its smooth relief is very highly prized.

WAYNESBORO SILT LOAM

Waynesboro silt loam has a 5 or 6 inch surface layer of yellowish-brown or grayish-brown silt loam. This grades into yellow friable silty clay loam which at a depth of 18 or 20 inches gives way to yellow compact silty clay loam showing some gray coloration along cracks. Below a depth of 2 feet is dull-red rather stiff but friable gritty clay, showing some yellow and orange streaks. The red color becomes more prominent with depth. Below a depth ranging from 30 to 36 inches is brick-red fine sandy clay which becomes more sandy with depth and grades at a depth of 3½ or 4 feet into brick-red fine sandy loam or loamy fine sand containing some streaks or layers of rounded quartz gravel and rotten sandstone pebbles, some fragments resembling coal, and some small iron concretions. In places this layer is more or less cemented and compact. On flatter areas the depth of the various layers varies considerably, compaction is greater, and more gray appears between depths of 20 and 24 inches. Such areas resemble Vincent silt loam. Small eroded areas included in mapping have a reddish or reddish-yellow fine sandy loam surface soil grading into red friable sandy clay.

This soil occurs only in the southwestern part of the county south of Little Hocking River in an old abandoned valley. It consists of old alluvial material that has been changed by weathering. Areas are flat or gently rolling, occupying low knolls or ridges and shallow hollows or valleys. The soil is well drained throughout. It is practically all cleared and devoted to general farming and truck and fruit growing. Corn yields from 30 to 40 bushels to the acre, wheat 18 or 20 bushels, and hay about 1 ton. Truck crops grown include tomatoes, cabbage, sweet corn, beans, potatoes, and cucumbers. This soil is easy of cultivation and is comparatively early.

Fertilizers are generally used with the grain and truck crops and in orchards. Superphosphate is used for grains and mixed fertilizers for truck. Some lime is used.

Land of this kind commands from $100 to $150 an acre, owing partly to the fact that most of it occurs along an improved highway.

Truck crops will return greater profits than general farm crops on this soil. Tests show the lime requirement to be about 1½ tons to the acre. After treatment with lime and superphosphate alfalfa can be grown.

WHEELING SILT LOAM

Wheeling silt loam has a rich-brown or yellowish-brown silt loam surface layer 6 or 8 inches thick, underlain by yellowish-brown friable silt loam giving way, at a depth of about 20 inches, to yellow, yellowish-brown, or buff friable silty clay loam containing some fine sand. Between depths of 26 and 30 inches this grades into loam, loamy sand, or gravelly loam. Below a depth of 3 or 4 feet the substrata consist of stratified fine sandy loam, loamy fine sand, silt, and gravel beds. In places the stratified sand and gravel beds lie only from 12 to 20 inches below the surface. Some small areas of loam were included in mapping.

Wheeling silt loam occurs on the high bottoms or terraces along Ohio and Muskingum Rivers. Areas are flat, hummocky, or very gently undulating, and drainage is good. The soil is all cleared and farmed, both to general and truck crops and to some extent to fruit. It is not so early as the sandy and gravelly soils.

In general this is regarded as an excellent wheat soil. Yields of this crop range from 20 to 30 bushels to the acre. Corn yields from 30 to 50 bushels and mixed timothy and clover about 1½ or 2 tons to the acre. Heavy applications of manure and fertilizer are made for truck crops, and superphosphate is usually applied with the grain crops. This soil is very easily managed.

The selling price of Wheeling silt loam ranges from $500 to more than $1,000 an acre. On account of its elevation above flood danger it is utilized as sites for farmhouses.

Tests show the lime requirement of this soil to be 1 or 2 tons to the acre. When limed and fertilized it is an excellent alfalfa soil.

WHEELING LOAM

Wheeling loam to a depth of 8 or 10 inches consists of rich-brown or dark grayish-brown loam. This grades down into yellowish or brownish-yellow compact silt loam underlain at a depth of about 18 inches by fairly compact yellow or brownish-yellow light-textured silty clay loam containing some small dark-brown iron concretions. Stratified gravel, sand, silt, and clay occur below a depth ranging from 34 to 40 inches.

This soil is mapped only on the Muskingum River terraces about 3 miles north of Marietta and about 1 mile south of and across the river from Lowell. All the land is cleared and farmed to truck crops. It occupies gently undulating or billowy situations and is very well drained.

Farming methods are similar to those used on Wheeling silt loam. Owing to its higher content of sand Wheeling loam is considered better suited to truck crops than the silt loam of the series.

WHEELING FINE SANDY LOAM

Wheeling fine sandy loam has a surface layer of rich-brown fine sandy loam 8 or 10 inches thick, grading into lighter-brown or yellowish-brown fine sandy loam or loam which at a depth of 18 or 20 inches becomes somewhat compact. When wet this material has a slightly reddish cast. Below a depth ranging from 24 to 30 inches is brownish-yellow loamy fine sand or fine sand which is underlain by stratified sand and gravel deposits.

Some small areas of very fine sandy loam and loam were included in mapped areas of this soil in the vicinity of Center Belpre. At Sandhill an included area is from 40 to 60 feet above the general elevation of this soil along the river and is separated from it by a rather steep, somewhat eroded slope. This material represents an old high-terrace soil that very closely resembles typical Wheeling fine sandy loam. This area is a part of the natural dam deposited across the former mouth of Little Muskingum River, forcing it to cut a new, more roundabout way to Ohio River. Other included areas consist of Wheeling loamy fine sand.

This soil occurs on the terraces of Ohio and Muskingum Rivers. It has all been cleared and is farmed, largely to truck crops to which it is well suited, owing to its early nature, ease of cultivation, level or gently undulating relief, and perfect drainage. Some areas are in orchards. Occurring as it does in the Ohio Valley, fruit is protected from frost damage by heavy river fogs. Only a small proportion of the soil is used for general farming.

Heavy applications of manure, when available, and of fertilizers are made for truck. Various fertilizers are used, but high-grade complete fertilizers and superphosphate-potash mixtures are most common. Soybeans, rye, and crimson clover are grown to maintain the supply of organic matter and nitrogen where barnyard manures are not available. Its natural adaptation to vegetables makes trucking the best use to which this soil can be put.

The current selling price of Wheeling fine sandy loam is about $1,000 an acre.

WHEELING GRAVELLY LOAM

Wheeling gravelly loam has a 6 or 8 inch brown, dark-brown, or grayish-brown gravelly loam surface layer grading into yellow slightly sticky but friable somewhat compact gravelly loam, underlain at a depth between 14 and 18 inches by reddish-yellow compact coarse gravelly loam which within a few inches gives way to yellow or slightly reddish-yellow sand and gravel. The gravel is variable in size, ranging from very small to good-sized cobblestones. It is principally crystalline or igneous material brought in by streams flowing from the central and northeastern Ohio glaciated regions. Below a depth of 10 feet the material is more or less calcareous in the areas below the mouth of Muskingum River, but is not noticeably calcareous in the other areas. The gravel above the mouth of the river contains a larger proportion of sandstone.

This soil occurs on terraces in bends on Muskingum River and near Newport, Gravelbank, and Rockland. It is of considerable importance locally, owing to its excellent adaptation to truck crops. All areas are cleared and are devoted principally to truck crops. The soil is flat, gently undulating, or slightly hummocky but is very well drained, even showing a tendency to become droughty during dry periods. The Belpre trucking district depends largely on this soil for its early truck.

Crops are heavily fertilized, and green cover crops are used or heavy applications of manure are made. The soil is very highly prized by all truck growers. It requires heavy fertilization.

The current selling price of Wheeling gravelly loam ranges from $800 to $1,500 an acre.

Wheeling gravelly loam, very gravelly phase.—The very gravelly phase of Wheeling gravelly loam is separated on the basis of gravel content. The material is extremely gravelly, consisting mainly of gravel and sand. Very little of the soil is mapped, but areas are on the west side of Muskingum River about 1 mile north of Marietta and just west of Lowell.

This soil is devoted exclusively to trucking and is very highly prized by truck growers. It is an especially early soil.

WHEELING LOAMY FINE SAND

The surface layer of Wheeling loamy fine sand is dark-brown loamy fine sand grading at a depth of 4 or 6 inches into brownish-yellow fine sand or loamy fine sand which gives way, at a depth of 12 or 15 inches, to brownish-yellow compact fine sandy loam or loamy fine sand. A little small gravel is present in many places. Below a depth of about 2 feet the material is yellow or brownish-yellow fine sand which becomes gradually coarser with depth. Stratified sand, silt, and gravel are reached at a depth of 5 or 6 feet.

Some included small areas near Rockland are of fine sand texture. At Sandhill a high-terrace phase similar in origin to Wheeling fine sandy loam is included.

This soil occurs most extensively at Rockland, Reno, and Newport, and smaller areas are mapped at widely scattered places along the Ohio River terraces. Areas are flat, ridgy, or billowy and are very well drained throughout. Although not of great extent the soil is locally important for truck crops. It is entirely cleared and is devoted principally to truck crops and melons. It is an early soil and is very easily handled, but its open porous subsoil renders it rather droughty in dry periods. This is not a serious drawback, however, as the vegetables are grown particularly for early markets.

Methods of farming are similar to those in use on other truck soils. Heavy fertilization is needed, and the use of cover crops is important.

MOSHANNON SILT LOAM

Moshannon silt loam consists of brown or brownish-red silt loam or heavy silt loam 8 or 10 inches thick, underlain by red or brownish-red silt loam or silty clay loam which continues to a depth of 2 or 3 feet where a variable substratum of sandstone gravel, sandy loam, or stream rubble occurs.

This soil is more or less variable. Patches of Moshannon loam are included, and along stream banks very narrow strips of fine sand or fine sandy loam may be found. Many narrow stream bottoms are so variable that they can not be accurately mapped and are of necessity included with this soil. Along the margin of the bottoms some colluvial material brought down from the adjacent slopes of Upshur and Meigs soils is included.

This soil occurs along streams which receive their drainage largely from Upshur and Meigs soils, where the alluvial deposits have a reddish color. It is the principal soil along the upper part of Little Muskingum River and its tributaries, East Fork Duck Creek, Whipple Run and Pawpaw Creek, South Branch Wolf Creek, and most of the creeks in the northwestern part of the county.

This soil is for the most part well drained, though it is subject to overflow and receives frequent additions of alluvial materials. In places it is cut by old stream channels that render it suitable only for pasture. Locally it is of importance, as the steep slopes adjacent are not suited to farming. Many farmers utilize the bottom land for grain and hay crops and hill land principally for pasture.

This soil is all cleared and used in the production of hay, corn, and pasture grasses. Little fertilizer is used. Tests for acidity indicate that this soil is neutral or alkaline, and this is borne out by the very excellent stand of bluegrass and clovers that it sustains. Hay yields from 1½ to 2½ tons to the acre and corn from 40 to 65 bushels. Though some wheat is grown, this is not an important crop on this soil. In most places alfalfa can be grown with little lime or fertilizer. The land seems to be best suited to hay and corn and can most profitably be used for these crops.

MOSHANNON SILTY CLAY LOAM

Moshannon silty clay loam consists of chocolate reddish-brown or dark-brown silty clay loam grading into red or light brownish-red silty clay or silty clay loam which at a depth ranging from 2 to 3 feet commonly contains shaly gravel or subangular fragments of sandstone and shale or stream rubble. Much of the coarse material appears to be micaceous and imparts a greasy feel to the soil.

This soil occurs along streams which drain uplands consisting of Upshur clay and Meigs silty clay loam. In the narrower stream bottoms, a variety of soils ranging from fine sandy loam to clay may be included, and on adjoining slopes on which Upshur clay occurs there is in many places a strip of colluvial material approximating clay in texture.

This soil for the most part is well drained, though it is subject to overflow. However, along old stream channels or in low sloughs there may be small local wet spots in which rushes flourish. The soil occurs principally along streams which drain the belt of Upshur soils in the central part of the county. Most of it is cleared, but in most places there is a fringe of trees along the stream banks.

Moshannon silty clay loam is devoted principally to hay and corn. Practically no fertilizer or lime is used. Bluegrass and clover sod in pastures is excellent, and alfalfa and sweetclover grow well. Hay yields about 2 tons and corn from 40 to 60 bushels to the acre The soil is best suited to these crops.

HUNTINGTON SILT LOAM

Huntington silt loam consists of rich-brown silt loam in most places becoming a shade lighter at a depth of 10 or 12 inches although there may be little change in color or texture to a depth of more than 3 feet. The subsoil may be light brown or yellowish brown and somewhat compact, and in places some rust-brown color may be seen. Some patches of silty clay loam and loam too small to be mapped separately are included with this soil.

Huntington silt loam occurs along streams that receive more or less of their drainage water from uplands derived from limestone or from mixed limestone, sandstone, and shale. The soil ranges from alkaline to but slightly acid in reaction. It is well drained. Areas are along Ohio and Muskingum Rivers and Duck and Wolf Creeks and some of their tributaries. The soil is practically entirely cleared and farmed to corn and hay. Alfalfa and clover do exceedingly well. Corn yields from 50 to about 100 bushels to the acre and hay 2 or 3 tons. No fertilizers are used, as the soil is enriched by overflow. Typical Huntington silt loam makes up only a small part of the soil as mapped, most of it being the high-bottom phase.

Huntington silt loam, high-bottom phase.—Huntington silt loam, high-bottom phase, differs from the typical soil in lying above normal overflow, being affected by overflow only at times of unusual floods. Its higher elevation enables its use for a greater variety of crops. Wheat, oats, and all kinds of truck are grown in addition to corn and hay. Corn yields from 60 to 100 bushels to the acre, wheat from 20 to 40 bushels, and hay from 3 to 5 tons. Near Marietta the soil is very highly prized for truck crops.

Small grains are usually fertilized with superphosphate and truck crops with a complete fertilizer or superphosphate and potash when no manure is available. This is considered one of the most valuable soils in this county. It commands from $600 to $1,000 an acre.

HUNTINGTON FINE SANDY LOAM

Huntington fine sandy loam is rich-brown fine sandy loam which may or may not become lighter in color at a depth of 10 or 15 inches. Small patches of sandy loam, loam, and fine or medium sand have been included in mapping.

This soil occurs in close association with Huntington silt loam, principally along Ohio and Muskingum Rivers. Most areas are along or near the river banks. The soil is subject to periodic overflow. It is all cleared, except for a fringe of trees along the stream banks here and there.

Corn and hay are the principal crops. Yields are about the same as on Huntington silt loam. No fertilizers are used, and as a rule no lime is needed as the soil shows an alkaline or only slightly acid reaction. All areas are well drained.

Huntington fine sandy loam, high-bottom phase.—Huntington fine sandy loam, high-bottom phase, differs from the typical soil in being much less subject to overflow. Corn, wheat, hay, and truck crops are grown. This soil is preferred to Huntington silt loam for truck crops because of its sandiness, ease of tillage, and the somewhat earlier maturity of crops on it. Alfalfa, soybeans, and clover as

well as mixed timothy and clover are grown. Yields are about the same as on Huntington silt loam.

Fertilizers are used on the grain crops, and heavy applications are usually made on the truck crops. The selling price of the soil ranges from $600 to more than $1,000 an acre.

LINDSIDE SILTY CLAY LOAM

To a depth of about 8 inches Lindside silty clay loam consists of grayish-brown silty clay loam or silt loam. This grades into compact dark-gray, grayish-brown, or brownish silty clay loam or silty clay containing small pockets, streaks, and veins of dark gray or streaks of brownish red and reddish yellow. Below a depth of about 24 inches the material is less compact and is yellowish-brown, grayish-brown, and gray silty clay loam. This might be considered as having once been a Huntington soil which, because of poor drainage, has become somewhat mottled and acid.

This soil occurs in the bottoms of Ohio River, mainly in rather small areas in sloughs or slightly depressed situations. Artificial drainage is needed. The vegetation consists partly of rushes, grasses, and weeds preferring a moist somewhat acid soil. During wet spells water sometimes stands on this soil.

Lindside silty clay loam is practically all cleared and is used principally for corn, hay, and pasture land. Corn averages 40 or 50 bushels to the acre if the land is drained. Hay is not of so good quality as that cut from the Huntington soils.

This soil needs drainage and liming. Tests show its lime requirement to be about 2 or 3 tons to the acre.

Owing to its association with the Huntington soils, this soil would probably sell for prices ranging from $300 an acre upward, although that is more than most of it is worth for agriculture.

ATKINS SILTY CLAY LOAM

Atkins silty clay loam is gray or brownish-gray silty clay loam to a depth of about 18 or 20 inches, where it grades into pale-yellow silty clay or silty clay loam mottled with some bluish gray and containing some rust-brown streaks and small concretions. Some small patches of imperfectly drained Moshannon soils are included in mapped areas.

Atkins silty clay loam occurs in poorly drained first bottoms along streams which carry drainage mainly from sandstone and shale uplands. It is mapped in only a few places, the principal areas being near Barlow, west of Layman, and along some of the small streams north and south of Bartlett in the extreme western part of the county. The land is cleared and is used principally as hay and pasture land. The vegetation is of rushes, redtop, and grasses which thrive on moist acid soils.

Since Atkins silty clay loam is subject to overflow it can not be used except for corn or for hay or pasture land. Corn yields about 20 or 25 bushels and hay 1 or 1½ tons to the acre. Were the land drained, limed, and fertilized crop yields would increase materially, as would the value of the soil for pasture.

STEEP BROKEN LAND

Steep broken land includes the areas that, because of steepness or rock outcrop, are totally unsuited to agriculture. Such land is best suited to forestry, though it affords some grazing. The soil includes both Muskingum and Upshur materials ranging in texture from loam to clay. Areas are extensive in the eastern part of the county in Grandview, Ludlow, Independence, Newport, and Lawrence Townships. Other areas occur along the Ohio River bluffs south of Marietta, along Muskingum River north of Lowell, and along branches of Little Hocking River and Wolf Creek in the western part of the county. Soil of this kind should be maintained in permanent forest.

SUMMARY

Washington County is in the southeastern part of Ohio bordering Ohio River. The land area is 630 square miles.

The uplands of the county are generally rolling or hilly. The valleys of Muskingum and Ohio Rivers are wide, and first bottoms and well-developed second bottoms or terraces occur in them. The elevation ranges from 580 feet above sea level to more than 1,200 feet.

Washington County was formed in 1788. The first settlement in the county was made on the site of Marietta the same year.

Railroad facilities are available only in the main valleys. The principal roads are highly improved. The leading local market is Marietta.

The climate is mild, the summers being warm and the winters open.

Agriculture in most of the county is of a general type, including cattle and sheep raising. In the main valleys and on some of the upland soils trucking is the most important form of agriculture. Tomatoes, cabbage, sweet corn, potatoes, and cucumbers are among the vegetables most extensively grown. Fruit raising is important along Ohio River and on some of the ridge lands.

Fertilizers are in general use for grain crops, and very heavy applications are made on truck crops.

The average size of the farms in 1925 was 84.9 acres. Many of the truck farms comprise only 5 or 10 acres.

Land values range from about $25 an acre to more than $1,000. The average value reported in 1924 was $28.85 an acre.

In general, the soils show a marked need for lime and phosphorus. In this county 21 soil types and 14 phases of types, representing 14 soil series, and the miscellaneous class of land, steep broken land, have been mapped.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]

Areas surveyed in Ohio, shown by shading

U. S. GOVERNMENT PRINTING OFFICE 1930

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