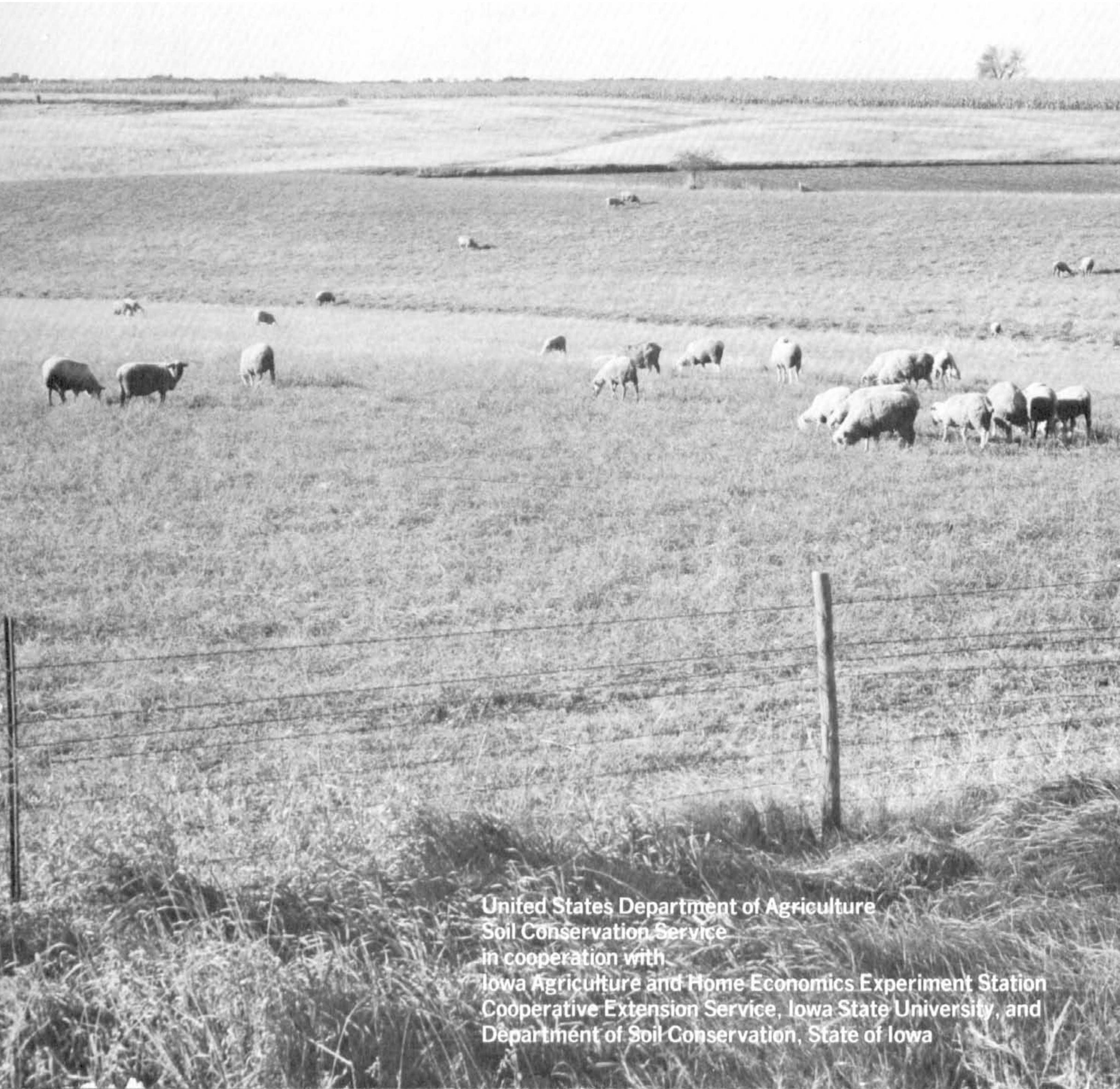
Soil survey of

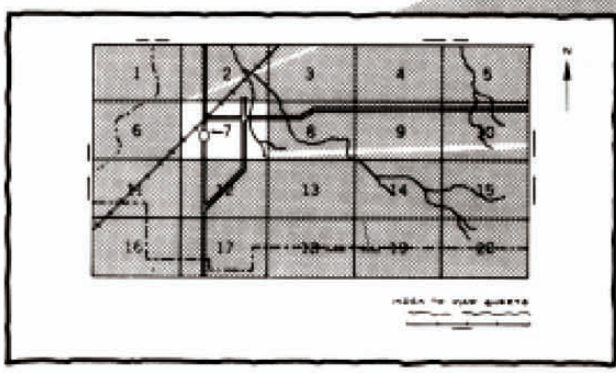
WAPELLO COUNTY, IOWA

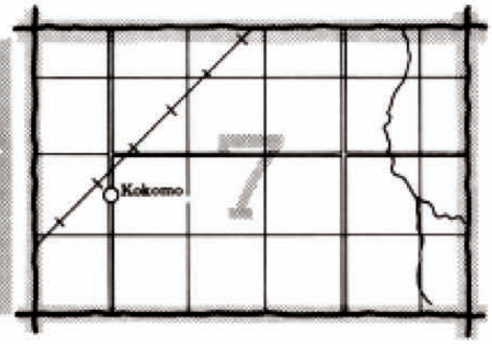


United States Department of Agriculture
Soil Conservation Service
in cooperation with
Iowa Agriculture and Home Economics Experiment Station
Cooperative Extension Service, Iowa State University, and
Department of Soil Conservation, State of Iowa

HOW TO USE

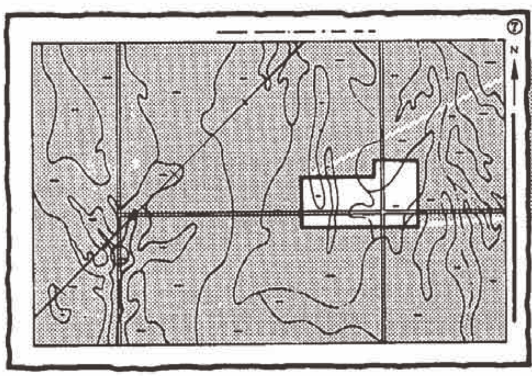
1. Locate your area of interest on the "Index to Map Sheets"

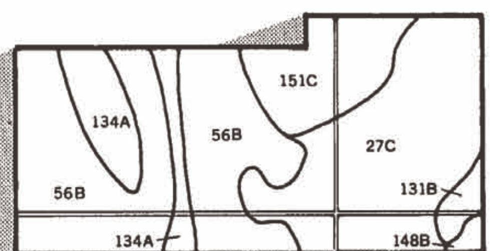




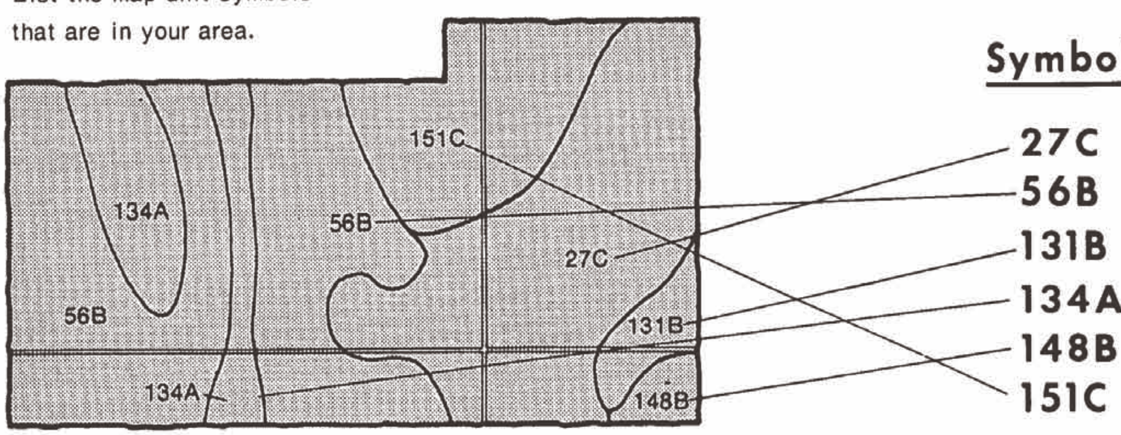
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



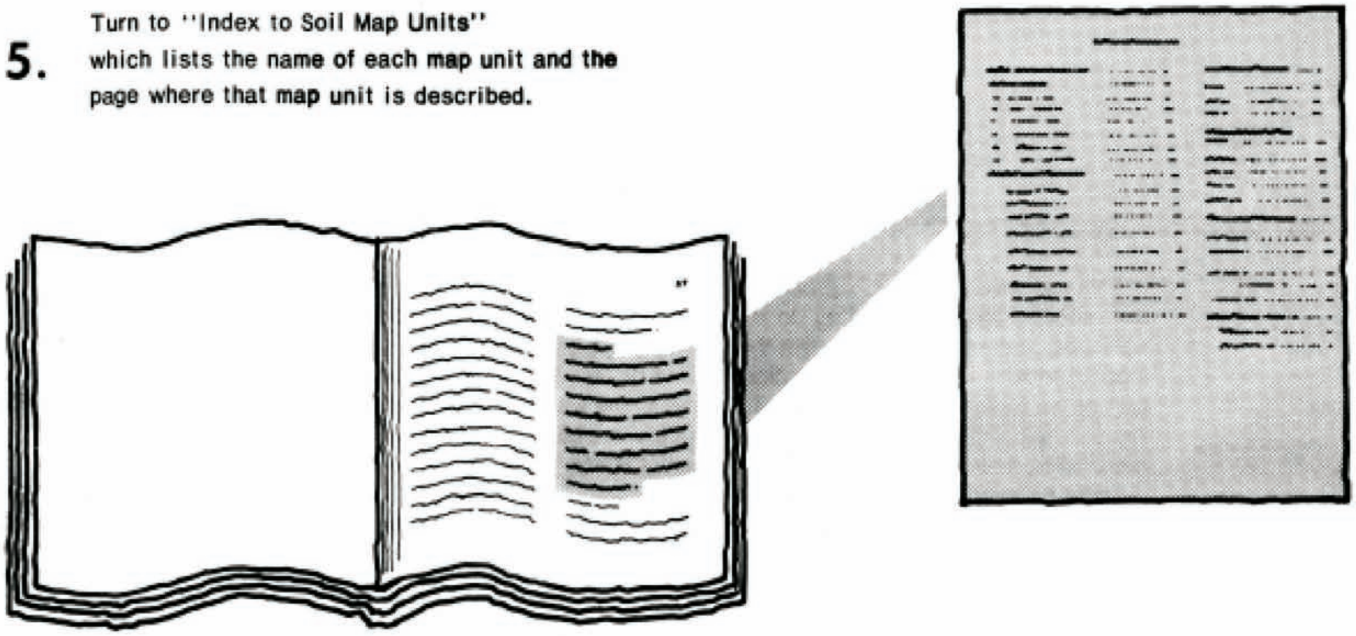


4. List the map unit symbols that are in your area.

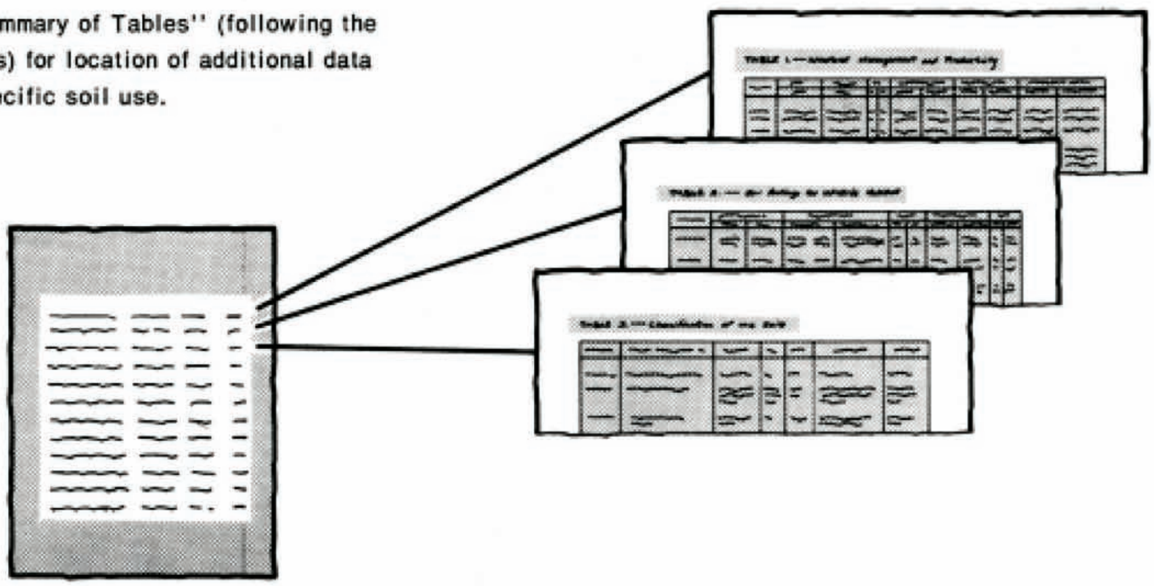


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agriculture Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the Iowa Agriculture and Home Economics Experiment Station, Cooperative Extension Service, Iowa State University, and The Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Wapello County Soil Conservation District. Funds appropriated by Wapello County were used to defray part of the cost of the survey. Major fieldwork was performed in the period 1973-1976. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976.

Cover: Sheep grazing on improved pasture on Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded.

contents

soil series

Issued March 1981

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summary of tables

preface

This soil survey contains information that can be used in land-planning programs in Wapello County, Iowa. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Soil survey of
Wapello County, Iowa

by James E. Seaholm, Soil Conservation Service

Fieldwork by James E. Seaholm, Charles A. Kiepe,
Lonnie R. Miller, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with the Iowa Agriculture and Home Economics Experiment
Station; the Cooperative Extension Service, Iowa State University; and
the Department of Soil Conservation, State of Iowa

WAPELLO COUNTY is in the southeastern part of Iowa (fig. 1). Ottumwa, the county seat, is about 83 miles southeast of Des Moines. The county has an area of about 279,360 acres or about 436 square miles. This soil survey of Wapello County updates the first survey, which was made in 1917 (*17*). It provides additional information and larger maps that show the soils in greater detail.

Much of the land area of the county is in farms and is used mainly for growing corn, soybeans, oats, hay, and pasture. A small area is in woodland. Corn and soybeans are the main grain crops. Raising hogs and feeding beef cattle are the principal livestock enterprises. The climate is subhumid and continental. The winters are cold, the summers are warm, and the growing season is long enough for all common crops to mature.

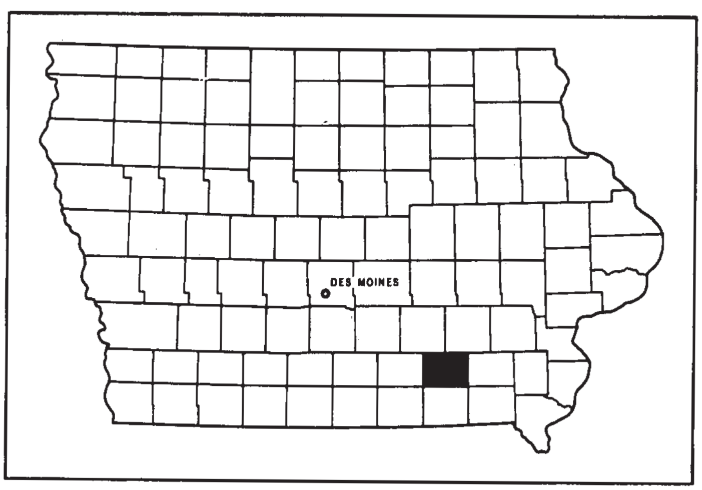

Figure 1.—Location of Wapello County in Iowa.

general nature of the county

This section gives general information concerning the county. It discusses climate, drainage and relief, history and development, and agriculture.

climate

Wapello County is cold in winter and is quite hot with occasional cool spells in summer. Precipitation during the winter frequently occurs as snowstorms. During the warm months it is chiefly in the form of showers, which are often heavy and occur when warm moist air moves in from the south. The total annual rainfall is normally adequate for corn, soybeans, and small grains.

Table 1 gives data on temperature and precipitation for the survey area, as recorded in Ottumwa, Iowa, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 25 degrees F, and the average daily minimum is 16 degrees. The lowest temperature on record, -22 degrees, occurred at Ottumwa on January 12, 1974. In summer the average temperature is 74 degrees, and the average daily maximum is 84 degrees. The highest temperature, 105 degrees, was recorded on July 10, 1966.

Growing degree days, shown in table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 23 inches, or 70 percent, usually falls during the period April through September, which includes the growing season for most crops. Two years in 10, the April-September rainfall is less than 19 inches. The heaviest 1-day rainfall during the period of record was 3.63 inches at Ottumwa on August 20, 1969. Thunderstorms number about 50 each year, 25 of which occur in summer.

Average seasonal snowfall is 27 inches. The greatest snow depth at any one time during the period of record was 27 inches. On the average, 22 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night in all seasons, and the average at dawn is about 81 percent. The percentage of possible sunshine is 70 percent in summer and 50 percent in winter. The prevailing direction of the wind is from the northwest. Average windspeed is highest, 13 miles per hour, in April.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration, and result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

drainage and relief

Two major Iowa drainage systems receive runoff from Wapello County. About 70 percent of the county is drained by the Des Moines River and its tributaries, and about 30 percent is drained by Cedar Creek, a tributary of the Skunk River. Brown, Chippewa, Comstock, Fudge, and Sugar Creeks flow into the Des Moines River from the north; Bear, Brush, Little Soap, Middle Avery, North Avery, Soap, South Avery, and Village Creeks flow into it from the south and west. Competine, Little Competine, Spring, and Wolf Creeks flow into Cedar Creek from the north; Buckeye, Honey, Little Cedar, and Jordan Creeks flow into it from the south and west.

The difference in elevation between the lowlands and adjoining uplands ranges from 150 to 200 feet along the Des Moines River and its tributaries and is only 40 to 60 feet in the northeastern part of the county along Cedar Creek and its tributaries. The elevation gradually increases towards the divides, especially south and southwest of the Des Moines River, where it is more than 200 to 300 feet above the water level of the river. Large areas between drainage systems, especially in the northeastern and eastern parts of the county, tend to be more nearly level and have only slight undulations of the land surface. The relief is more vigorous in marginal areas near the flood plains of the larger streams.

The highest point of elevation, 918 feet above sea level, is about 0.5 mile south of Blakesburg. The lowest point in the county, about 600 feet, is where the Des Moines River crosses the southeastern boundary into Davis County.

history and development

Wapello County was named for Chief Wapello, who was chief of the Foxes and second in command of the federated tribes of Sacs and Foxes. These two tribes inhabited the area before it was opened for settlement in 1843 (*20*). In accordance with the Treaty of 1837, only eight non-Indian families were permitted to live in the territory at that time. Although he was a close friend of the Indian agent, General Street, Chief Wapello refused to cede any of the land to the United States. It was not until after his death in 1842 that the Indians ceded to the United States all lands to which they had title (*20, 9*).

Wapello County was opened for settlement in 1843 and organized under a board of commissioners in 1844. The first and only county seat was located in Ottumwa, but was named Louisville for some time. Both names, Louisville and Ottumwa, were used interchangeably bv the governing body in its early meetings.

The first census was taken in 1850, at which time the population of the county was 8,471. From 1840 to 1850 the non-Indian population of Wapello County increased by more than 8,000. The population continued to increase steadily until 1900, when it was 35,426. By 1950 the population reached 47,397. Since 1950, however, the population has declined, and by 1970 the population of the county was 42,149.

The first railroad in the county was completed to Ottumwa in 1859. By 1893, railroads connecting Ottumwa with Kansas City, Omaha, Chicago, Minneapolis, Milwaukee, San Francisco, and New York provided outlets for farm products and industry and supplied the people of Wapello County with whatever goods they needed. At present, four railroad lines go through Wapello County, and several branch lines connect the major communities.

Two major highways are centrally located in the county. U.S. Highway 34 traverses the county from east to west and intersects north to south U.S. Highway 63 at Ottumwa. Hard surface state and county roads connect these highways to all the smaller communities. All farms are on farm-to-market roads of gravel or crushed limestone. Major county roads are well distributed.

Bus transportation is available in Ottumwa for travel in all directions. Ottumwa has an airport 4 miles north of the city limits. Motor freight lines serve every trading center.

agriculture

In 1970, more than 65 percent of the population of Wapello County was in the city of Ottumwa, and only about 15 percent was on farms. Of the 436 square miles, or 279,360 acres, in the county, about 220,000 acres are tillable. The trend in recent years has been toward fewer and larger farms run by younger operators than in the past (*4*). In 1976, the county reported 1,490 farms with an average size of 170 acres. Production on these farms has been increasing overall, and much of this has been the result of increased efficiency.

Corn and soybeans are the main row crops produced. Agriculture is of prime importance to the total economy of Wapello County. It provides a livelihood for farmers as well as for those engaged in business, professions, finance, and many related agri-business activities.

Livestock production is becoming more specialized, with more of the county's farmers producing only one class of livestock. Recent trends show an increase in the number of confinement livestock systems, primarily in swine production.

Farm production expenses make a sizeable contribution to the total economy of the county. In any one year, they can amount to nearly half the total cash receipts for crops and livestock. They include the cost of feed, seed, fertilizer, chemicals, fuels, oil, machinery, and other products—most or all of which are purchased locally.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one soil association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Weller-Lindley-Keswick association

Moderately well drained and well drained, gently sloping to very steep soils that formed in loess and glacial till; on uplands

The soils of this association have the steepest slopes and are in the most dissected part of the county. Soils that have slopes of 2 to 9 percent are on long, narrow, rounded ridgetops. Soils that have slopes of 9 to 40 percent are on long, narrow, convex side slopes.

This association (fig. 2) covers about 24 percent of the county. About 33 percent of the association is Weller soils, 25 percent is Lindley soils, 14 percent is Keswick soils, and the remaining 28 percent is soils of minor extent.

Weller soils are gently sloping to strongly sloping. They are on long, narrow, convex ridgetops. Weller soils formed in loess under a native vegetation of deciduous trees. They are moderately well drained and have slow permeability. Weller soils have high shrink-swell potential.

Lindley soils are strongly sloping to very steep. They are on long, narrow, convex side slopes. Lindley soils formed in glacial till under a native vegetation of deciduous trees. They are well drained and have moderately slow permeability. Lindley soils have moderate shrink-swell potential.

Keswick soils are strongly sloping to moderately steep. They are on long, very narrow, convex side slopes below the Weller soils and above the Lindley soils on the landscape. Keswick soils formed in glacial till under a native vegetation of deciduous trees. They are moderately well drained, but have seepy areas during wet periods. Keswick soils have slow permeability. They have high shrink-swell potential.

The minor soils in this association mainly are Beckwith, Cantril, Gosport, and Nodaway soils. Gosport soils make up 13 percent of this association. They are strongly sloping to very steep and formed in shale residuum. Gosport soils are moderately well drained and are very slowly permeable. They have a high shrink-swell potential. The nearly level Beckwith soils are on small flats on the tops of ridges. The gently sloping Cantril soils are on foot slopes below the Lindley soils on the landscape. Nodaway soils are along the narrow drainageways at the bottom of the narrow valleys.

The soils on some of the ridgetops are used for row crops (fig. 3), and some soils that have less than 18 percent slopes are used for hay. Most of the soils in this association, however, are used for pasture, woodland, and wildlife.

About 30 percent of the association is gently sloping to strongly sloping soils on ridgetops. These soils are moderately suited to row crops. Because they have moderately slow or slow permeability, they tend to warm and dry more slowly in spring than soils with moderate permeability. Erosion is the major hazard. The steeper soils on the lower side slopes are better suited to pasture and trees. Slope and the hazard of erosion are the major limitations of these steeper soils. Overgrazing and grazing when the soils are wet are major concerns of pasture management because erosion and gullying can develop rapidly. In woodland areas the steep slopes restrict the use of logging equipment, and erosion is a hazard along logging roads and skid trails.

2. Pershing-Armstrong-Gara association

Somewhat poorly drained to well drained, gently sloping to steep soils that formed in loess and glacial till; on uplands

The soils of this association that have slopes of 2 to 9 percent are on long, narrow, rounded ridgetops and upper side slopes. Soils that have slopes of 9 to 25 percent are on convex side slopes.

This association covers about 15 percent of the county. About 41 percent of the association is Pershing

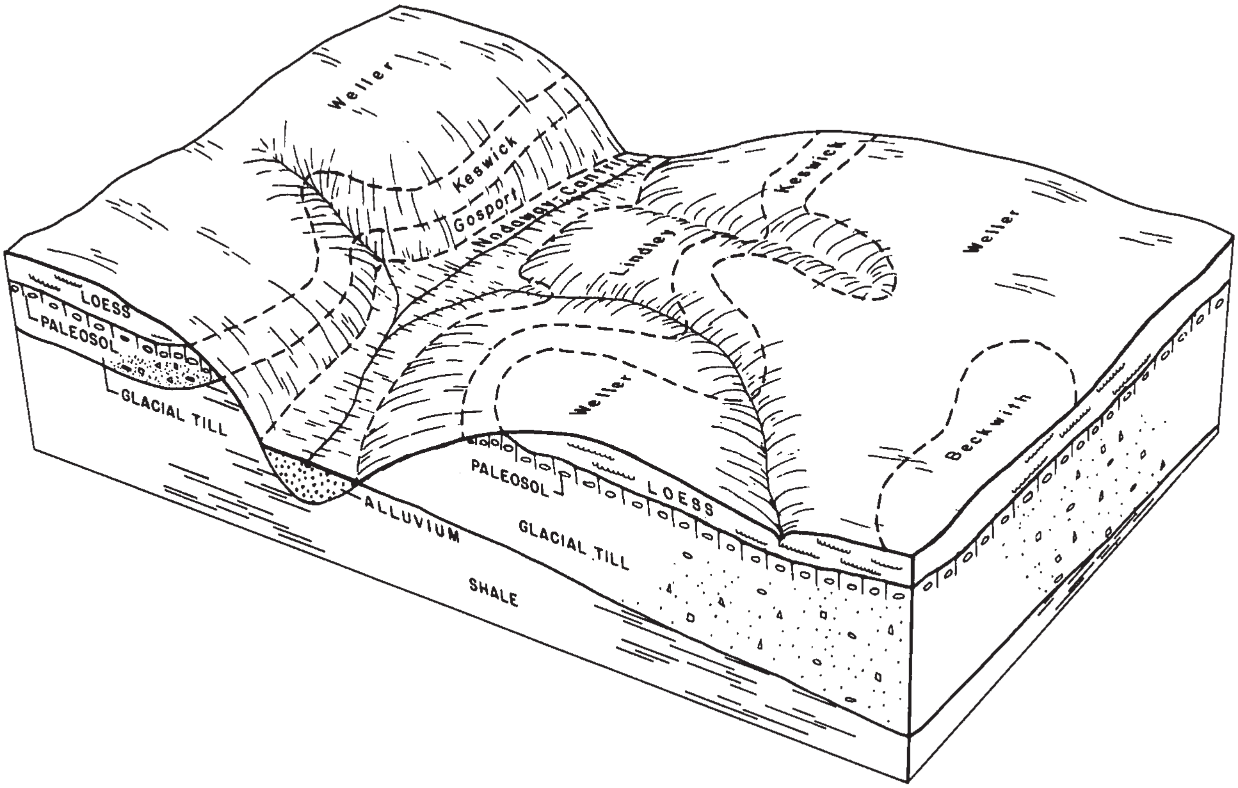

Figure 2.—Typical pattern of soils and underlying material in the Weller-Lindley-Keswick association.

soils, 14 percent is Armstrong soils, 9 percent is Gara soils, and the remaining 36 percent is soils of minor extent.

Pershing soils are gently sloping or moderately sloping. They are on long, narrow, convex ridgetops and upper side slopes. Pershing soils formed in loess under a native vegetation of mixed prairie grasses and deciduous trees. They are somewhat poorly drained or moderately well drained and have slow permeability. Pershing soils have high shrink-swell potential.

Armstrong soils are mostly strongly sloping. They are on long, very narrow, convex side slopes below the Pershing soils and above the Gara soils on the landscape. Armstrong soils formed in glacial till under a native vegetation of mixed prairie grasses and deciduous trees. They are somewhat poorly drained or moderately well drained and have seepy spots during wet periods. Armstrong soils are slowly permeable. They have high shrink-swell potential.

Gara soils are strongly sloping to steep. They are on long, narrow, convex side slopes. Gara soils formed in glacial till under a native vegetation of mixed prairie grasses and deciduous trees. They are moderately well drained or well drained and have moderately slow permeability. Gara soils have moderate shrink-swell potential.

The minor soils in this association are mainly Arispe, Belinda, Cantril, Nodaway, and Rinda soils. Arispe soils are moderately sloping soils on upper side slopes. Belinda soils are on nearly level flats on the tops of ridges. Cantril soils are on gently sloping foot slopes below the Gara soils on the landscape. Nodaway soils are along narrow drainageways at the bottom of the narrow valleys. Rinda soils are moderately sloping or strongly sloping soils that are on narrow, convex side slopes below the Pershing soils and above the Armstrong soils on the landscape.

The soils on the ridgetops are used for row crops, hay, and pasture and the soils on the side slopes are used mostly for hay and pasture (fig. 4).

About 65 percent of the association is on ridgetops and upper side slopes. These soils are moderately suited to row crops. Erosion is the major hazard. Because these soils have slow or moderately slow permeability, they tend to warm and dry more slowly in spring than soils with moderate permeability.

The steeper soils on the sides slopes are better suited to pasture. Overgrazing and grazing when the soils are wet are major concerns of pasture management because erosion and gullying can develop rapidly. Slope in steep areas can be a hazard when operating farm machinery.

3. Nodaway-Colo association

Moderately well drained to poorly drained, nearly level and gently sloping soils that formed in recent alluvium; on bottom land

The soils of this association are on flood plains of the major and minor streams of the county.

The association covers about 15 percent of the county. About 34 percent of the association is Nodaway soils, 17 percent is Colo soils, and the remaining 49 percent is soils of minor extent.

Nodaway soils are nearly level or gently sloping. They are on long, narrow areas of bottom land along the minor streams in the county. Nodaway soils formed in recent alluvium and are moderately well drained. They are subject to flooding. They have moderate permeability. Nodaway soils have moderate shrink-swell potential.

Colo soils are nearly level or gently sloping. They are on bottom land in irregularly shaped areas along the larger streams and long, narrow areas along the smaller streams. Colo soils formed in recent alluvium and are poorly drained. They have moderate permeability. Colo soils have high shrink-swell potential.

The minor soils are numerous, and most of them formed in recent alluvium. All of these soils are nearly level, except for the Humeston and Richwood soils which are nearly level or gently sloping. The Richwood soils are well drained. The Landes soils are well drained and moderately well drained. The Nevin soils are somewhat poorly drained. The Coppock soils are somewhat poorly drained or poorly drained. The Tuskeego and Zook soils are poorly drained. The Humeston soils are poorly drained or very poorly drained.

The soils in this association are mostly used for cultivated crops, hay, and pasture (fig. 5). More than 80 percent of the association is well suited or moderately suited to row crops. Flooding and wetness are the major limitations of these soils; however, Red Rock Dam has reduced the flooding in the Des Moines River flood plain.

4. Otley-Ladoga-Gara association

Moderately well drained and well drained, gently sloping to steep soils that formed in loess and glacial till; on uplands

The soils of this association that have slopes of 2 to 9 percent are on long, narrow, rounded ridgetops and

Figure 3.—Contour stripcropping and crop rotation reduce soil loss in the Weller-Lindley-Keswick association.

Figure 4.—Pastureland in the Pershing-Armstrong-Gara association.

upper side slopes. Soils that have slopes of 9 to 25 percent are on long, narrow, convex side slopes (fig. 6).

This association covers about 10 percent of the county. About 45 percent of the association is made up of Otley soils, 10 percent is Ladoga soils, 8 percent is Gara soils, and the remaining 37 percent is soils of minor extent.

Otley soils are gently sloping or moderately sloping and are typically adjacent to broad flats. They are on long, narrow, convex upper side slopes and ridgetops. Otley soils formed in loess under a native vegetation of tall prairie grasses. They are moderately well drained and have moderate permeability. Otley soils have moderate shrink-swell potential.

Ladoga soils are gently sloping or moderately sloping and are typically adjacent to moderately broad flats. They are on long, narrow, convex ridgetops and upper side slopes. Ladoga soils formed in loess under a native vegetation of mixed prairie grasses and deciduous trees. They are moderately well drained and have moderate permeability. Ladoga soils have moderate shrink-swell potential.

Gara soils are strongly sloping to steep. They are on long, narrow, convex side slopes. Gara soils formed in glacial till under a native vegetation of mixed prairie grasses and deciduous trees. They are moderately well drained or well drained and have moderately slow permeability. Gara soils have moderate shrink-swell potential.

The minor soils in this association are mainly Adair, Armstrong, Clarinda, Hedrick, and Nira soils. Adair and Armstrong soils are mostly strongly sloping. They are on narrow, convex side slopes below Otley and Ladoga soils on the landscape. Clarinda soils are moderately sloping and are on narrow, convex side slopes below Otley soils. Hedrick and Nira soils are moderately sloping. They are in coves at the heads of drainageways and on convex side slopes.

The soils in this association are mostly used for cultivated crops, hay, and pasture. About 75 percent of the acreage of these soils is well suited or moderately suited to row crops. The hazard of erosion is the main limitation. Overgrazing and grazing when the soils are wet are major concerns of pasture management because erosion and gullying can develop rapidly.

5. Clinton-Lindley-Keswick association

Moderately well drained and well drained, gently sloping to very steep soils that formed in loess and glacial till; on uplands

The soils of this association that have slopes of 2 to 14 percent are on long, narrow, rounded ridgetops. Soils that have slopes of 9 to 40 percent are on long, convex side slopes.

This association (fig. 7) covers about 10 percent of the county. About 30 percent of the association is Clinton soils, 22 percent is Lindley soils, 11 percent is Keswick soils, and the remaining 37 percent is soils of minor extent.

Clinton soils are gently sloping to strongly sloping. They are on long, narrow, convex ridgetops. Clinton soils formed in loess under a native vegetation of deciduous trees. They are moderately well drained and have moderately slow permeability. Clinton soils have moderate shrink-swell potential.

Lindley soils are strongly sloping to very steep. They are on long, narrow, convex side slopes. Lindley soils formed in glacial till under a native vegetation of deciduous trees. They are well drained and have moderately slow permeability. Lindley soils have moderate shrink-swell potential.

Keswick soils are strongly sloping to moderately steep. They are on long, very narrow, convex side slopes below the Clinton soils and above the Lindley soils on the landscape. Keswick soils formed in glacial till under a native vegetation of deciduous trees. They are moderately well drained, but are seepy during wet periods. Keswick soils have slow permeability. They have high shrink-swell potential.

Some minor soils in this association are Cantril, Gosport, and Nodaway soils. The gently sloping Cantril soils are on foot slopes below the Lindley soils on the landscape. Gosport soils formed in residuum from shale. Nodaway soils are along narrow drainageways at the bottom of the narrow valleys. They formed in recent alluvium.

The soils on ridgetops are used for cultivated crops, hay, and pasture, and the steeper soils on the side slopes are used mostly for hay and pasture. Some soils are used for woodland and for wildlife habitat.

About 40 percent of the association is moderately suited to row crops. Erosion is the major hazard. The steeper soils on the side slopes are better suited to pastures and trees. Slope and the hazard of erosion are the major limitations on these steeper soils. Overgrazing and grazing the soils when they are wet, are the major concerns of pasture management because erosion and gullying can develop rapidly. In woodland areas the steep slopes restrict the use of logging equipment, and erosion is a hazard along logging roads and skid trails.

Figure 5.—Pastureland on the bottom land in the Nodaway-Colo association.

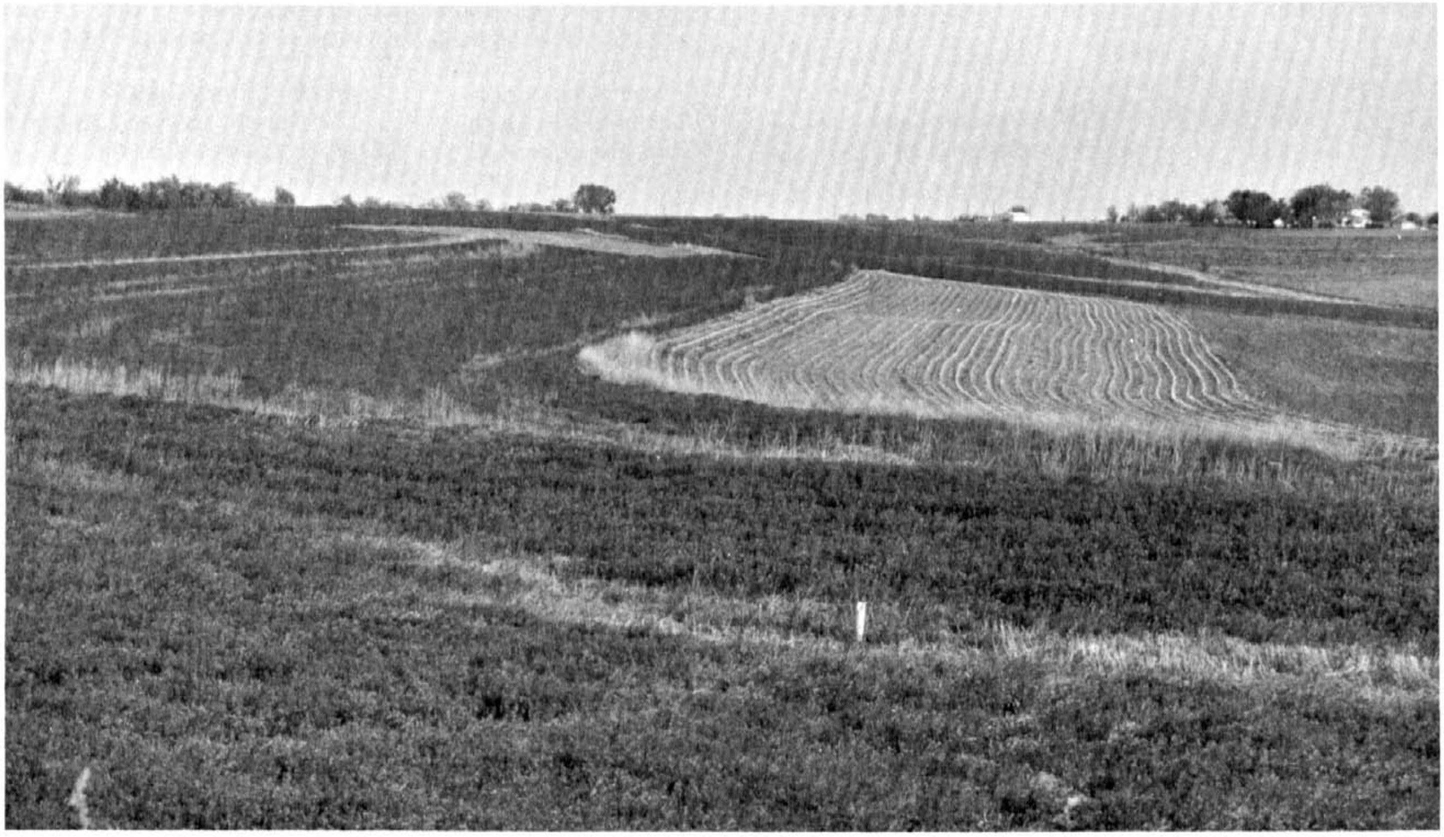

Figure 6.—Tile outlet terraces, contour stripcropping, and crop rotation reduce soil loss in the Otley-Ladoga-Gara association.

6. Galland-Clinton-Ladoga association

Somewhat poorly drained and moderately well drained, gently sloping to moderately steep soils formed in old alluvial sediments and loess; on high benches

The soils of this association that have slopes of 2 to 9 percent are on long, narrow, rounded ridgetops. Soils that have slopes of 5 to 18 percent are on long, narrow, moderately sloping to moderately steep, convex side slopes.

This association covers about 10 percent of the county. About 24 percent of the association is Galland soils, 13 percent is Clinton soils, 11 percent is Ladoga soils, and the remaining 52 percent is soils of minor extent.

Galland soils are moderately sloping to moderately steep. They are on long, narrow, convex side slopes. Galland soils formed in stratified, water-sorted glacial sediments under a native vegetation of deciduous trees. They are moderately well drained or somewhat poorly drained. Galland soils have slow permeability. They have high shrink-swell potential.

Clinton soils are gently sloping or moderately sloping. They are on long, narrow, convex ridgetops. Clinton soils formed in loess under a native vegetation of deciduous trees. They are moderately well drained and have moderately slow permeability. Clinton soils have moderate shrink-swell potential.

Ladoga soils are gently sloping or moderately sloping. They are on long, narrow, convex ridgetops. Ladoga soils formed in loess under a native vegetation of mixed prairie grasses and deciduous trees. They are moderately well drained and have moderate permeability. Ladoga soils have moderate shrink-swell potential.

The minor soils in this association are mainly Douds, Mystic, Otley, Pershing, and Weller soils. The strongly sloping to very steep Douds soils are on convex side slopes below the Clinton soils on the landscape. The moderately sloping or strongly sloping Mystic soils are on convex side slopes below the Ladoga, Otley, and Pershing soils on the landscape. The gently sloping or moderately sloping Otley, Pershing, and Weller soils are on ridgetops above the Galland, Douds, and Mystic soils on the landscape.

The soils in this association are mostly used for cultivated crops, hay, and pasture. Over 60 percent of the acreage is moderately well suited or well suited to row crops. Erosion is the major hazard. The steeper soils on the side slopes are better suited to pastures. Overgrazing and grazing when the soils are wet are the major concerns of pasture management because erosion and gullying can develop rapidly.

7. Haig-Grundy association

Poorly drained and somewhat poorly drained, nearly level and gently sloping soils that formed in loess; on uplands

The soils of this association have 0 to 5 percent slopes and are on broad flats and long, narrow, convex upper side slopes.

This association covers about 9 percent of the county. About 45 percent of the association is Haig soils, 39 percent is Grundy soils, and the remaining 16 percent is soils of minor extent.

Haig soils are nearly level. They are on broad flats. Haig soils formed in loess under a native vegetation of prairie grasses. They are poorly drained and have slow permeability. Haig soils have high shrink-swell potential.

Grundy soils are gently sloping. They are on long, narrow, convex upper side slopes. Grundy soils formed in loess under a native vegetation of prairie grasses. They are somewhat poorly drained and have slow permeability. Grundy soils have high shrink-swell potential.

The minor soils in this association are mainly Arispe and Edina soils. The moderately sloping Arispe soils are on convex side slopes below the Grundy soils on the landscape. The nearly level Edina soils are on broad flats adjacent to the Haig soils on the landscape.

The soils in this association are mainly used for cultivated crops. All of these soils are well suited or moderately suited to row crops. Because these soils have slow permeability, they tend to warm and dry more slowly in spring than soils with moderate or moderately slow permeability. Wetness is the major limitation on the flats, and erosion is a hazard on the side slopes.

8. Mahaska-Taintor association

Somewhat poorly drained and poorly drained, nearly level and gently sloping soils that formed in loess; on uplands

The soils of this association have slopes of 0 to 5 percent and are on broad flats and long, narrow, convex upper side slopes.

This association covers about 7 percent of the county. About 49 percent of the association is Mahaska soils, 40 percent is Taintor soils, and the remaining 11 percent is soils of minor extent.

Mahaska soils are nearly level or gently sloping. They

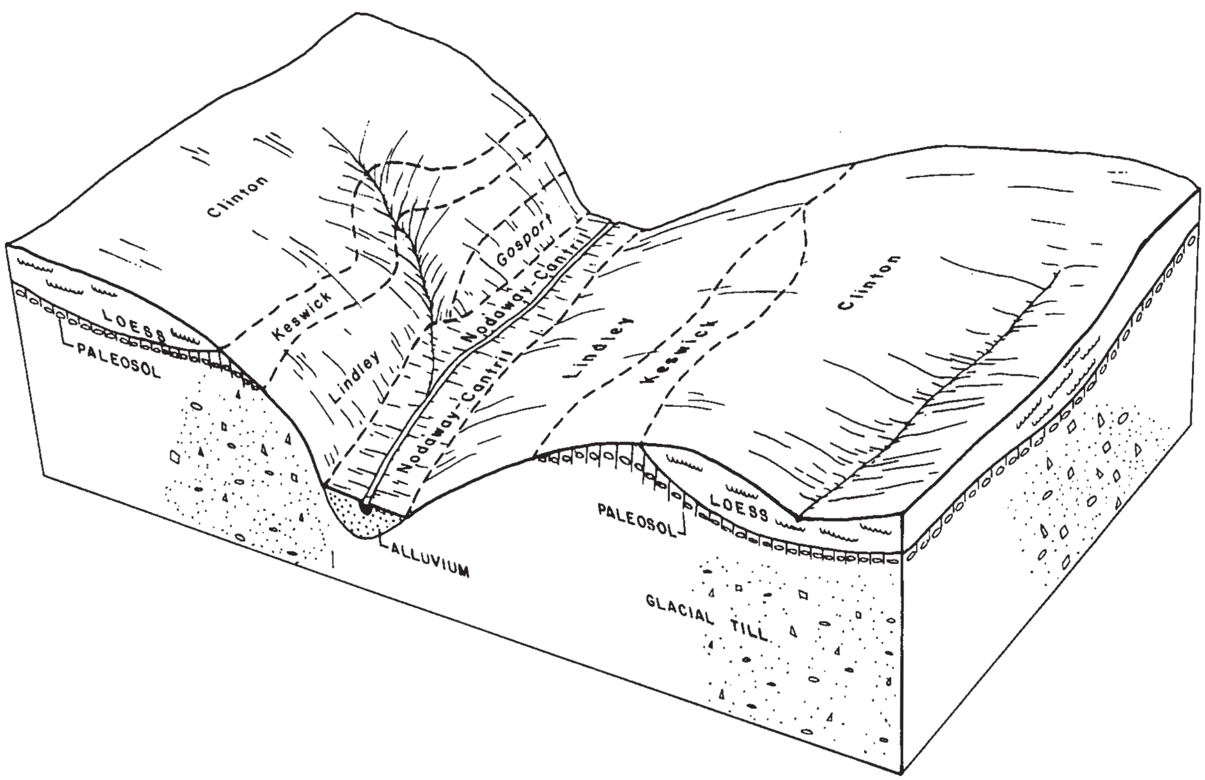

Figure 7.—Typical pattern of soils and underlying material in the Clinton-Lindley-Keswick association.

are on the edge of broad flats and on long, narrow, convex upper side slopes. Mahaska soils formed in loess under a native vegetation of prairie grasses. They are somewhat poorly drained and have moderate permeability. Mahaska soils have moderate shrink-swell potential.

Taintor soils are nearly level and are on broad flats. Taintor soils formed in loess under a native vegetation of prairie grasses. They are poorly drained and have moderately slow permeability. Taintor soils have high shrink-swell potential.

The minor soils in this association are mostly Kalona and Sperry soils. Kalona and Sperry soils are on the flats adjacent to Taintor soils on the landscape.

The soils in this association are mostly used for cultivated crops. About 98 percent of these soils are well suited to row crops. Wetness is the major limitation on the flats, and erosion is a hazard on the side slopes.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Weller silt loam, 2 to 5 percent slopes, is one of several phases in the Weller series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Nodaway-Cantril complex, 2 to 5 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimiliar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Urban land, 0 to 2 percent slopes, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

7—Wiota silt loam, 1 to 3 percent slopes. This nearly level, well drained or moderately well drained soil is on low stream terraces. Areas are irregular in shape. They range from 10 to 20 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer, extending to a depth of 20 inches, is very dark brown and very dark grayish brown silt loam. The subsoil is about 30 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is brown, friable silty clay loam. The substratum to a depth of 72 inches or more is brown silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Nevin and Richwood soils. Nevin soils are more poorly drained than the Wiota soil and are in the lower lying areas and along drainageways. The well drained Richwood soils contain less clay in the subsoil than the Wiota soil and are in small areas throughout the unit.

This Wiota soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer typically is slightly acid, unless limed; and the reaction of the subsoil commonly is slightly acid or medium acid. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled. It warms early in spring and can be worked soon after rains. The subsoil is very low in available phosphorus and low in available potassium.

This Wiota soil is used mostly for row crops. It has good potential for cultivated crops, hay and pasture, and trees. This soil has fair to good potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture.

This soil is seldom used for pasture or hay because mostly it is used for row crops. If it is used for pasture, however, overgrazing or grazing when the soil is too wet can cause surface compaction and result in poor tilth.

This soil is in capability class I.

11B—Colo-Ely silty clay loams, 2 to 5 percent slopes. This complex consists of gently sloping soils along narrow drainageways or on narrow foot slopes. It is about 60 percent Colo silty clay loam and 30 percent Ely silty clay loam. The drainageways receive runoff from higher areas, and some areas flood. The poorly drained Colo soil occupies the lower parts of the slopes, and the somewhat poorly drained Ely soil occupies the upper parts. Areas are long and narrow and range from 10 to 30 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Colo soil is black silty clay loam about 10 inches thick. The subsurface layer, extending to a depth of about 39 inches, is silty clay loam. The upper part is black and very dark gray, and the lower part is very dark gray. The substratum to a depth of 60 inches or more is dark gray silty clay loam.

Typically, the surface layer of the Ely soil is very dark brown silty clay loam about 8 inches thick. The subsurface layer, extending to a depth of about 28 inches, is silty clay loam. The upper part is very dark gray, and the lower part is very dark grayish brown. The subsoil is about 22 inches thick. The upper part is very dark grayish brown, mottled, friable silty clay loam, and the lower part is dark grayish brown, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is dark grayish brown, mottled silty clay loam.

Included with this complex in mapping and making up about 10 percent of the unit are small areas of Zook soils. Zook soils are more difficult to drain than the Colo soil. The Zook soils are on the lowest part of the foot slopes and are along the drainageways.

The permeability of the Colo and Ely soils is moderate. The available water capacity is very high for the Ely soil and high for the Colo soil. Runoff is medium or slow. The water table is seasonally high.

Except where limed, the surface layer of the Colo soil is slightly acid, and the surface layer of the Ely soil is medium acid. The subsoil of the Ely soil is medium acid. It is very low in available potassium and available phosphorus. The lower part of the subsurface layer of the Colo soil is very low in available potassium and medium in available phosphorus. The surface layer of both soils is 4.0 to 5.0 percent organic matter. The surface layer is easily tilled under optimum moisture conditions, but if worked when wet, it is likely to become hard and cloddy when dry.

These soils are used mostly for row crops, hay, and pasture. They have good potential for cultivated crops, hay, and pasture, and poor potential for trees and for most engineering uses.

These soils are well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time on these soils if adequate drainage and protection against runoff from higher areas can be provided. Tile drains function satisfactorily and in many places diversion terraces may be needed.

If these soils are used for pasture, overgrazing or grazing when the soils are wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This complex is in capability subclass IIw.

13B—Humeston-Vesser-Colo complex, 2 to 5 percent slopes. This complex consists of gently sloping soils along narrow drainageways or on narrow foot slopes. It is about 40 percent Humeston silt loam, 25 percent Vesser silt loam, and 25 percent Colo silty clay loam. The drainageways receive runoff from higher areas, and some areas flood. The poorly drained to very poorly drained Humeston soil and the somewhat poorly drained to poorly drained Vesser soil occupy the upper parts of the slopes, whereas the poorly drained Colo soil occupies the lower parts. Areas are long and narrow and range from 10 to 30 acres or more. These soils are so intermingled or so small in area that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Humeston soil is black silt loam about 10 inches thick. The subsurface layer, extending to a depth of about 20 inches, is silt loam. The upper part is black, and the lower part is dark gray. The subsoil is over 40 inches thick. The upper part is very dark gray, mottled, very firm silty clay, and the lower part is grayish brown and light brownish gray, mottled, very firm silty clay.

Typically, the surface layer of the Vesser soil is very dark grayish brown silt loam about 8 inches thick. The subsurface layer, extending to a depth of about 27 inches, is silt loam. The upper part is very dark grayish brown, and the lower part is dark gray. The subsoil is more than 33 inches thick and is grayish brown, mottled, firm silty clay loam.

Typically, the surface layer of the Colo soil is black silty clay loam about 10 inches thick. The subsurface layer is about 34 inches thick. It is black silty clay loam in the upper part and very dark gray silty clay loam in the lower part. The substratum to a depth of 60 inches or more is dark gray silty clay loam.

Included with this complex in mapping and making up about 10 percent of the unit are small areas of Coppock, Nodaway, Tuskeego, and Zook soils. Coppock soils contain less organic matter than the Vesser soil, and they are near the Vesser soil on the landscape. The Nodaway soils contain less clay and organic matter than the Colo soil. The Nodaway soils are also stratified and are near the Colo soil on the landscape. Zook soils have more clay than the Colo soil and are near the Colo soil on the landscape. In some places these soils have been disturbed by excavation for streets and buildings.

The permeability of the Humeston soil is moderately slow in the upper part and very slow in the lower part. The permeability of the Vesser and Colo soils is moderate. The available water capacity of all three soils is high, and runoff is slow or medium. These soils have a seasonal high water table.

The surface layer of these soils generally is medium acid or slightly acid, but in places the surface layer of the Humeston soil is strongly acid. The subsoil of the Humeston soil is strongly acid, and the subsoil of the Vesser soil is medium acid. The surface layer of the Colo and Humeston soils is 4.0 to 5.0 percent organic matter. That of the Vesser soil is 3.0 to 4.0 percent organic matter. The lower part of the deep subsurface layer of the Colo soil is medium in available phosphorus and very low in available potassium. The subsoil of the Vesser soil is medium in available phosphorus and low in available potassium. The subsoil of the Humeston soil is medium or low in available phosphorus and very low in available potassium. These soils are easily tilled under optimum moisture conditions, but if the Colo soil is worked when wet, it is likely to become hard and cloddy when dry.

These soils are used mostly for row crops, hay, and pasture. They have fair to good potential for cultivated crops, good potential for hay and pasture, and poor potential for trees and for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains and are well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage and protection against runoff from higher areas can be provided. Tile drains function satisfactorily in the Vesser and Colo soils; however, they do not function as well in the Humeston soil. In many places diversion terraces may be needed.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soils are wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotations, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and the soil in good condition.

This complex is in capability subclass IIIw.

23C—Arispe silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained or somewhat poorly drained soil is on short, convex side slopes and in coves at the heads of drainageways in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 40 acres or more.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the middle part is dark grayish brown, mottled, firm silty clay loam; and the lower part is olive gray and light olive gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light olive gray, mottled silty clay loam. In some places there are moderately eroded areas where the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Clarinda and Clearfield soils on the lower parts of the side slopes above the drainageways. The Clarinda and Clearfield soils are more poorly drained than the Arispe soil.

This Arispe soil has moderately slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is slightly acid, unless limed. The reaction of the subsoil is medium acid. The surface layer is 3.0 to 4.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it is likely to become hard and cloddy when dry. The subsoil is very low in available phosphorus and low in available potassium.

This soil is used mostly for row crops, hay, and pasture. It has fair to good potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. It has poor to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains and is well suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, there is a severe hazard of erosion. Conservation tillage helps to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

23C2—Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on short, convex side slopes and in coves at the heads of drainageways in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 20 to 50 acres or more.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 37 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam, and the lower part is grayish brown and light olive gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light olive gray, mottled silty clay loam. In some severely eroded areas the surface layer is mostly dark grayish brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Clarinda and Clearfield soils on the lower parts of the side slopes above the drainageways. Clarinda and Clearfield soils are more poorly drained than the Arispe soil.

This Arispe soil has moderately slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed. The reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it is likely to become hard and cloddy when dry. The subsoil is very low in available phosphorus and low in available potassium.

This Arispe soil is used mostly for row crops, hay, and pasture. It has fair to good potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains. It is well suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, there is a severe hazard of further erosion. Conservation tillage helps to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Arispe soil, and it requires more production inputs to maintain higher yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

41B—Sparta loamy fine sand, 1 to 4 percent slopes. This nearly level and gently sloping, excessively drained soil is on low stream terraces and high benches. Areas are irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark brown loamy fine sand about 9 inches thick. The subsurface layer is very dark brown and dark brown loamy fine sand about 14 inches thick. The subsoil is dark brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of 60 inches or more is brown fine sand.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of somewhat poorly drained Hoopeston soils. The Hoopeston soils are more poorly drained and have a higher available water capacity than the Sparta soil. Hoopeston soils are in shallow depressions and along drainageways. In some places the soil has been disturbed by excavation for streets and buildings.

This Sparta soil has rapid permeability. The available water capacity is low, and runoff is slow. The shrink-swell potential is low. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 0.5 to 1.0 percent organic matter. It is very friable and easily tilled. It warms early in the spring and can be worked soon after rains. The subsoil is very low in available phosphorus and available potassium.

This Sparta soil is used mostly for row crops, hay, and pasture. It has fair to poor potential for cultivated crops and fair potential for hay and pasture and for trees. This soil has good potential for most engineering uses.

This soil is moderately to poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Conservation tillage and farming on the contour can be used on these droughtly soils to help conserve moisture and control erosion. Plowing these soils in the fall subjects them to wind erosion. The hazard of wind erosion can be reduced by leaving a rough plowed surface and alternating plowed and unplowed strips. It can also be greatly reduced by chisel plowing, which leaves crop residue on the surface. Chisel plowing also helps to conserve moisture. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Pasture management on this droughty soil is difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, are essential to keep the pasture and soil in good condition.

This soil is suited to trees, but most trees are in groves and around farmsteads. Natural and planted seedlings do not survive well unless they are planted closely together and thinned to achieve the desired stand density.

This soil is in capability subclass IVs.

41C—Sparta loamy fine sand, 4 to 10 percent slopes. This moderately sloping, excessively drained soil is on high benches. Areas are irregular in shape and range from 10 to 80 acres or more.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 7 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, very friable loamy fine sand, and the lower part is brown, very friable loamy fine sand. The substratum to a depth of 60 inches or more is brown fine sand. In some places the surface layer is dark grayish brown loamy fine sand.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of moderately well drained Douds soils. The available water capacity is higher in Douds soils than in the Sparta soil. Douds soils occupy the lower parts of the side slopes.

This Sparta soil has rapid permeability. The available water capacity is low, and runoff is slow to medium. The shrink-swell potential is low. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil commonly is medium acid. The surface layer is 0.5 to 1.0 percent organic matter. It is very friable and very easily tilled, but the slopes make it very erosive. The surface layer warms early in spring and can be worked soon after rains. The subsoil is very low in available phosphorus and available potassium.

This Sparta soil is used mostly for pasture, hay, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has good potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, there is a severe hazard of erosion. Conservation tillage and farming on the contour can be used on these droughty soils to help conserve moisture and control erosion. Plowing these soils in the fall subjects them to wind erosion, but the hazard of wind erosion can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. It can also be greatly reduced by chisel plowing, which leaves crop residue on the surface. Chisel plowing also helps to conserve moisture. Returning crop residue to the soil or the regular addition of other organic material prevents fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking, pasture rotation, and timely deferment of grazing, especially, during dry periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, but most trees are in groves and around farmsteads. Natural and planted seedlings do not survive well unless they are planted closely together and thinned later to achieve the desired stand density.

This soil is in capability subclass IVs.

41E—Sparta loamy fine sand, 10 to 20 percent slopes. This strongly sloping and moderately steep, excessively drained soil is on high stream terraces. Areas are irregular in shape and range from 10 to 40 acres or more.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 5 inches thick. The subsoil is brown, very friable loamy fine sand about 21 inches thick. The substratum to a depth of 60 inches or more is yellowish brown fine sand. In some places the surface layer is dark grayish brown loamy fine sand.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of moderately well drained Douds soils. Douds soils have more clay and less sand than the Sparta soil and occupy the lower parts of the side slopes.

This Sparta soil has rapid permeability. The available water capacity is low, and runoff is medium or rapid. The shrink-swell potential is low. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 0.5 to 1.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for hay, pasture, and wildlife. This Sparta soil is not suited to cultivated crops because of the very severe hazard of erosion. It has fair potential for hay, pasture, and trees. This soil has fair to poor potential for openland wildlife habitat and woodland wildlife habitat. This soil has fair to poor potential for most engineering uses.

This Sparta soil is moderately suited to grasses and legumes for hay and pasture. The use of the soil for pasture or hay is effective in controlling erosion. Pasture management on this droughty soil is difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, are essential to keep the pasture and soil in good condition. On the steeper parts of this unit, ordinary farm machinery is both difficult and dangerous to use.

This soil is suited to trees, but most trees are in groves and around farmsteads. Natural and planted seedlings do not survive well unless they are planted closely together and thinned later to achieve the desired stand density.

This soil is in capability subclass VIIs.

51—Vesser silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained or poorly drained soil is on the higher part of the flood plain, foot slopes, and alluvial fans. It is subject to flooding. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is very dark gray and dark gray silt loam about 21 inches thick. The subsoil is more than 30 inches thick. The upper part is gray, mottled, friable silty clay loam, and the lower part is grayish brown, mottled, firm silty clay loam. In some small areas the very dark gray surface layer and subsurface layer are less than 10 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Humeston soils that occur throughout the map unit. Humeston soils are more poorly drained and more difficult to drain than the Vesser soil.

This Vesser soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 3.0 to 4.0 percent organic matter. This soil is friable and easily tilled under optimum moisture conditions, but it tends to warm and dry more slowly in spring than soils with less clay in the subsoil. The subsoil is medium in available phosphorus and low in available potassium.

This soil is used mostly for row crops, hay, and pasture. It has good potential for crops, hay, and pasture. It has poor potential for trees. This soil has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage and protection against runoff from higher areas can be provided. Tile drains function satisfactorily in these soils, if suitable outlets are obtained. In many places diversion terraces on adjacent foot slopes can be used.

When this soil is used for pasture, overgrazing, or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability subclass IIw.

54—Zook silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on the flood plain, and is subject to flooding. Areas are irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is dark gray silty clay loam about 8 inches thick. The subsurface layer, extending to a depth of about 35 inches, is black silty clay loam in the upper part and black silty clay in the lower part. The subsoil is black, firm silty clay about 13 inches thick. The substratum to a depth of 62 inches or more is dark gray, mottled silty clay. In some small areas the surface layer is very dark grayish brown silty loam overwash up to 10 inches thick. In other places the dark gray silty clay subsoil is at a depth of about 30 inches.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Colo soils that are throughout the map unit. Colo soils are easier to drain than the Zook soil.

This Zook soil has slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is slightly acid, unless limed, and the reaction of the subsoil is neutral. The surface layer is 5.0 or 7.0 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it is likely to become very hard and cloddy when dry. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for row crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture. It has poor potential for trees. This soil has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage and protection against runoff from higher areas can be provided. Adequate drainage is difficult to establish, however. Tile drains are only fairly effective because the soil is slowly permeable, and flooding limits their use in low areas. In many places suitable outlets cannot be obtained. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. In places diversion terraces on adjacent foot slopes can be used.

Pasture management on this poorly drained soil is difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

56B—Cantril loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on slightly concave to straight upland foot slopes below moderately steep to very steep Gara and Lindley soils. Areas are long and narrow and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 43 inches thick. The upper part is grayish brown and dark yellowish brown, friable loam; the middle part is grayish brown and dark yellowish brown, friable clay loam; and the lower part is dark grayish brown, mottled, friable clay loam. The substratum to a depth of 60 inches or more is dark brown and dark grayish brown clay loam. In some small areas the very dark grayish brown surface layer and subsurface layer are more than 10 inches thick. In other small areas the surface layer is grayish brown loam overwash up to 8 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Coppock soils on the lower part of the foot slopes. Coppock soils contain more silt and less sand than the Cantril soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Cantril soil has moderate permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is slightly acid, unless limed. The reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and available potassium.

This Cantril soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture. It has good potential for trees. This soil has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. It receives excess runoff from adjacent slopes. In many places diversion terraces can be used for protection against runoff from higher areas. If the soil is used for crops, there is a moderate hazard of erosion. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

58D2—Douds loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on high stream benches along major streams and rivers in the county. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. Generally, plowing has mixed some subsoil into the surface layer. The subsoil is about 50 inches thick. The upper part is brown, friable loam; the middle part is strong brown, mottled, friable sandy clay loam; and the lower part is strong brown, mottled, very friable sandy loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled sandy loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Clinton and Galland soils. Clinton soils contain more silt and less sand than the Douds soil, and they are on the upper parts of the side slopes. Galland soils contain more clay in the subsoil than the Douds soil, and they are on the lower parts of the side slopes. In some places the soil has been disturbed by excavation for streets and buildings.

This Douds soil has moderate permeability. The available water capacity is moderate, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed. The reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for hay or pasture. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has a fair to poor potential for most engineering uses.

This soil is moderately to poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of erosion, but row crops can be grown some of the time on these soils if adequate erosion protection is provided. Conservation practices, such as terracing, farming on the contour, and conservation tillage, all help to reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This Douds soil is suited to trees. Native hardwood seedlings, however, require a site of better quality and grow more satisfactorily if planted on uncultivated soil. Conifers are better suited than hardwoods to eroded or formerly cultivated soils. No particular problems should be encountered in planting new stands of trees if proper species are selected and managed properly.

This soil is in capability subclass IVe.

58E—Douds loam, 14 to 18 percent slopes. This moderately steep, moderately well drained soil is on high stream benches along the major streams and rivers in the county. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown and brown loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is brown, friable loam; the middle part is strong brown, mottled, friable loam and sandy clay loam; and the lower part is multicolored, friable loam. The substratum to a depth of 60 inches or more is brown and yellowish brown, mottled loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small areas the very dark grayish brown surface layer is 6 to 10 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Clinton, Galland, and Gosport soils. Clinton and Gosport soils are on the upper parts of the side slopes, and Galland soils are on the lower parts. Clinton soils contain more silt and less sand than the Douds soil, Galland soils contain more clay in the subsoil than the Douds soil, and Gosport soils contain shaley clays. In some places the soil has been disturbed by excavation for streets and buildings.

This Douds soil has moderate permeability. The available water capacity is moderate, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed; and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This Douds soil is used mostly for pasture, hay, and woodland. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. It is very highly susceptible to erosion. The use of this soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas, but because this soil is moderately steep, the operation of farm machinery can be both difficult and dangerous. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of the trails or roads used in logging in order to reduce the hazard of erosion. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there is some hazard in the operation of farm equipment. Special equipment can be used if caution is exercised.

This soil is in capability subclass VIe.

58E2—Douds loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil is on high stream benches along major streams and rivers in the county. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. Generally, plowing has mixed some subsoil into the surface layer. The subsoil is about 44 inches thick. The upper part is brown, friable loam; the middle part is brown and strong brown, mottled, friable loam; and the lower part is strong brown and yellowish brown, mottled, friable sandy clay loam. The substratum to a depth of 60 inches or more is grayish brown and brown, mottled loam. In some severely eroded areas the surface layer is mostly brown loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Galland and Gosport soils. Galland soils are on the lower parts of the side slopes, and the Gosport soils are on the upper parts. Galland soils contain more clay in the subsoil than the Douds soil and Gosport soils contain clayey shale. In some places the soil has been disturbed by excavation for streets and buildings.

This Douds soil has moderate permeability. The available water capacity is moderate, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture and hay. It has poor potential for cultivated crops, poor to fair potential for hay and pasture, and fair potential for trees. This soil has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately to poorly suited to grasses and legumes for hay and pasture. It is very highly susceptible to erosion damage. The use of this soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas of this moderately steep soil; however, the operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees; however, native hardwood seedlings require a site of better quality and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited than hardwoods to eroded or formerly cultivated soils. Careful consideration should be given to the location of the trails or roads used in logging in order to reduce the hazard of erosion. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

58G—Douds soils, 18 to 40 percent slopes. This steep and very steep, moderately well drained soil is on high stream benches along major streams and rivers in the county. Areas of this soil are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable loam; the middle part is brown and strong brown, mottled, friable loam; and the lower part is strong brown, mottled, friable sandy clay loam. The substratum to a depth of 60 inches or more is grayish brown and yellowish brown, mottled loam. In some small, severely eroded areas the surface layer is mostly brown loam.

Included with this soil in mapping and making up 10 to 15 percent of the unit are areas of a soil that has stratified sand throughout the profile. Also included are small areas of Galland and Gosport soils throughout the map unit. Galland soils contain more clay in the subsoil than the Douds soil, and Gosport soils contain shaley clay. In some places the soil has been disturbed by excavation for streets and buildings.

This Douds soil has moderate permeability. The available water capacity is moderate, and runoff is very rapid. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for woodland, pasture, and wildlife. This soil is not suited to cultivated crops. It has poor potential for hay and pasture and fair potential for trees. It has fair to good potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This steep and very steep soil is very highly susceptible to erosion, and it is not suitable for row crops. This Douds soil is poorly suited to grasses and legumes for pasture; however, the use of this soil for pasture is effective in controlling erosion. Pasture management on this soil is difficult. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition. Ordinary farm machinery is both difficult and dangerous to use on these steep and very steep slopes.

This soil is suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

65E—Lindley loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on convex, narrow ridgetops, nose slopes, and side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled loam. In some moderately eroded areas, some of the subsoil is mixed with the surface layer. There are other small areas where the very dark grayish brown surface layer is 6 to 8 inches thick. In some places the soil has been disturbed by excavation for streets and buildings.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Douds, Gosport, and Keswick soils. The Douds and Gosport soils are on the lower parts of the side slopes, and the Keswick soils are on the upper parts. The Douds soils are more stratified than the Lindley soil, and the Gosport soils contain clayey shale. The Keswick soils are seepy during wet periods and contain more clay in the subsoil than the Lindley soil.

This Lindley soil has moderately slow permeability. The available water capacity is high, and runoff is rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and woodland. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. It is very highly susceptible to erosion. The use of this soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas of this moderately steep soil; however, the operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex, narrow ridgetops, nose slopes, and side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. Generally, plowing has mixed some subsoil into the surface layer. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled loam. In some severely eroded areas the surface layer is mostly yellowish brown clay loam. In some places the soil has been disturbed by excavation for streets and buildings.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Douds, Gosport, and Keswick soils. The Douds and Gosport soils are on the lower part of the side slopes, and the Keswick soils are on the upper part. The Douds soils are more stratified than the Lindley soil, the Gosport soils contain shaley clay, and the Keswick soils are seepy during wet periods and contain more clay in the subsoil than the Lindley soil.

This Lindley soil has moderately slow permeability. The available water capacity is high, and runoff is rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is typically medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture and hay. It has poor potential for cultivated crops, fair to poor potential for hay and pasture, and fair potential for trees. This soil has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately to poorly suited to grasses and legumes for hay and pasture. It is very highly susceptible to erosion damage. The use of this soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas on this moderately steep soil. The operation of farm machinery can be both difficult and dangerous and needs to be done with caution. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. If areas of this soil are planted to trees, careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution. Seedlings do not survive well and, consequently, should be planted closely together to achieve desired stand density. Plant competition is generally not a problem.

This soil is in capability subclass VIe.

65F—Lindley loam, 18 to 25 percent slopes. This steep, well drained soil is on convex, narrow nose slopes and on valley side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 20 to 100 acres or more.

Typically, the surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 34 inches thick. The upper part is strong brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 79 inches or more is yellowish brown and grayish brown loam. In some moderately eroded areas some of the subsoil is mixed with the surface layer, and in other severely eroded areas the surface layer is mostly strong brown loam. In other small areas the surface layer is very dark grayish brown loam about 6 to 8 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Douds, Gosport, and Keswick soils. Douds and Gosport soils are on the lower parts of the side slopes, and Keswick soils are on the upper part. Douds soils are more stratified than the Lindley soil, Gosport soils contain clayey shale, and Keswick soils are seepy during wet periods and contain more clay in the subsoil than the Lindley soil.

This Lindley soil has moderately slow permeability. The available water capacity is high, and runoff is very rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 2.0 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, woodland, and wildlife. It is not suited to cultivated crops. It has poor potential for hay and pasture and fair potential for trees. It has fair to good potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This steep soil is very highly susceptible to erosion. It is not suitable for row crops. This soil is poorly suited to grasses and legumes for pasture; however, the use of this soil for pasture is effective in controlling erosion. Pasture management on this soil is difficult. If used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition. On these steep slopes, ordinary farm machinery is both difficult and dangerous to use.

This soil is suited to trees, and a few small areas remain in native hardwoods. Trees grow best on the northerly and easterly lower slopes and in coves. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

65G—Lindley loam, 25 to 40 percent slopes. This very steep, well drained soil is on valley side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is strong brown, mottled loam. In some moderately eroded areas some of the subsoil is mixed with the surface layer. In other severely eroded areas the surface layer is mostly brown loam or brown clay loam. In some areas it is very dark grayish brown and about 6 to 8 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Keswick and Gosport soils. Keswick soils are on the upper part of the side slopes, and Gosport soils are on the lower parts, generally at elevations below 750 feet. Keswick soils are seepy during wet periods and contain more clay in the subsoil than the Lindley soil, and Gosport soils contain shaley clay.

This Lindley soil has moderately slow permeability. Available water capacity is high, and runoff is very rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 2.0 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, woodland, and wildlife. It is not suited to cultivated crops. It has poor potential for hay and pasture and fair potential for trees. It has fair to good potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This very steep soil is very highly susceptible to erosion. It is not suitable for row crops. It is poorly suited to grasses and legumes for pasture; however, the use of this soil for pasture is effective in controlling erosion. Pasture management on this very steep soil is difficult. If used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition. Ordinary farm machinery is both difficult and dangerous to use on these very steep slopes.

This soil is suited to trees, and a few small areas remain in native hardwoods. Trees grow best on the northerly and easterly lower slopes and in coves. Careful consideration should be given to the location of trails or roads used in logging on this soil so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

75B—Givin silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is adjacent to narrow to moderately broad flats and is on narrow to moderately wide, convex ridgetops and upper side slopes in the loess-covered uplands. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 41 inches thick. The upper part is dark grayish brown and brown, friable silty clay loam; the middle part is dark grayish brown and grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay loam. Gray, clayey glacial till is at a depth of about 11 feet.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of moderately well drained Ladoga soils on the narrow, convex ridgetops.

This Givin soil has moderately slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

76B—Ladoga silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is adjacent to narrow to moderately broad flats on convex ridgetops and upper side slopes in loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 43 inches thick. The upper part is brown, friable silty clay loam; the middle part is brown and yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of 70 inches or more is yellowish brown, mottled silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Givin soils that are on the less sloping parts of this unit and are more poorly drained than the Ladoga soil.

This Ladoga soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

76C—Ladoga silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 35 inches thick. The upper part is brown, friable silty clay loam; the middle part is brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Hedrick soils that are at the heads of drainageways. Hedrick soils contain less clay in the subsoil than the Ladoga soil and have a grayer subsoil.

This Ladoga soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material helps to maintain tilth, improves fertility, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

80B—Clinton silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 61 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of 86 inches or more is yellowish brown, mottled silt loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of somewhat poorly drained soils that have a grayer colored subsoil and are more poorly drained than the Clinton soil. These somewhat poorly drained soils are on the less sloping parts of the map unit. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium and strongly acid. The surface layer is 1.5 to 2.5 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time, but there is a moderate hazard of erosion. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Also, intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as it dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material helps to maintain tilth, improve fertility, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

80C—Clinton silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 100 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is over 51 inches thick. The upper part is brown, friable silty clay loam; the middle part is brown and dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Ashgrove and Keswick soils on the lower parts of the side slopes. Both soils are seepy during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, pasture, and woodland. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion; however, row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil.

Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust as it dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material helps to maintain tilth, improves fertility, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This Clinton soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

80C2—Clinton silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 100 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is more than 54 inches thick. The upper part is dark yellowish brown, friable silty clay loam; the middle part is yellowish brown, firm, silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. In some small, severely eroded areas the surface layer is mostly dark yellowish brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Ashgrove and Keswick soils on the lower parts of the side slopes. Ashgrove and Keswick soils are seepy during wet periods. Also included are small areas of a well drained, moderately permeable soil that contains less clay in the subsoil and drains better than the Clinton soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. This soil has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion, but row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Intensive use for row crops causes the surface layer to puddle after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil generally needs more nitrogen than the Clinton soil that is less eroded, and it requires greater production input to maintain high yields and to maintain or improve soil tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the level of organic matter content of this moderately eroded soil. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Hardwood seedlings require a site of better quality and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited than hardwoods to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation will need to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

80D2—Clinton silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on the upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 4 to 30 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 50 inches thick. The upper part is brown, friable silty clay loam; the middle part is brown, firm silty clay loam; and the lower part is grayish brown, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is grayish brown silty clay loam. In some small, severely eroded areas the surface layer is mostly brown silty clay loam, and in other small areas the surface layer is uneroded and the soil is in woodland.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ashgrove and Keswick soils that are on the lower parts of the side slopes and are seepy during wet periods. Also included are small areas of a well drained, moderately permeable soil that has slope of 9 to 18 percent. This soil contains less clay in the subsoil and drains better than the Clinton soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair potential for cultivated crops and good potential for hay, pasture, and trees. This soil has fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, there is a very severe hazard of erosion, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Also, intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on the crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil needs more nitrogen than the less eroded Clinton soils and requires greater production input to maintain high yields and to maintain or improve soil tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the level of organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Hardwood seedlings require a site of better quality and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited than hardwoods to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation will need to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low stream terraces and rarely floods. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark brown silty clay loam about 11 inches thick. The subsurface layer is very dark brown silty clay loam about 8 inches thick. The subsoil is about 37 inches thick. The upper part is very dark grayish brown, friable silty clay loam; and the lower part is dark grayish brown, mottled, friable silty clay loam. The substratum to a depth of 72 inches or more is grayish brown, mottled silty clay loam. In some places the subsoil is silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Colo and Wiota soils. Colo soils are in shallow depressions and along drainageways, and Wiota soils are on the highest parts of the map unit. Colo soils are more poorly drained and Wiota soils are better drained than the Nevin soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Nevin soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is slightly acid or neutral, and the reaction of the subsoil is medium acid or slightly acid. The surface layer is 3.5 to 4.5 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is medium in available phosphorus and high in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. Drainage is adequate on this somewhat poorly drained soil, but in wet years tile drains can be beneficial for timely field operations in some areas that occupy low positions on the landscape.

This land is seldom used for pasture or hay, because it is used mostly for crops. However, when the soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability class I.

93D2—Shelby-Adair clay loams, 9 to 14 percent slopes, moderately eroded. This complex consists of strongly sloping, moderately well drained or somewhat poorly drained soil on short, convex nose slopes and side slopes in the uplands. It is about 60 percent Shelby clay loam and about 30 percent Adair clay loam. The moderately well drained Shelby soil is on the lower parts of the side slopes, and the moderately well drained to somewhat poorly drained Adair soil is on the upper parts. Areas are elongated, narrow, and irregular in shape and range from 10 to 30 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Shelby soil is very dark gray clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is brown, firm clay loam about 35 inches thick. The substratum to a depth of 72 inches or more is brown and grayish brown clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam.

Typically, the surface layer of the Adair soil is very dark gray clay loam about 8 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is more than 52 inches thick. The upper part is brown, mottled, firm clay loam; the middle part is dark yellowish brown, very firm clay with yellowish red mottles; and the lower part is yellowish brown, mottled, firm clay loam. In some small, severely eroded areas the surface layer is brown clay loam.

Included with this complex in mapping and making up about 10 percent of this unit are small areas of Clarinda soils. Clarinda soils are on the upper parts of the side slopes and are more poorly drained than the Adair soil.

The Shelby soil has moderately slow permeability, and the Adair soil has slow permeability. The available water capacity of both soils is high, and runoff is rapid. The Adair soil has a seasonal high water table. The shrink-swell potential is high in the Adair soil and moderate in the Shelby soil. The surface layer of these soils is medium acid, unless limed, and the subsoil is strongly acid or medium acid. The surface layer is 1.5 to 3.5 percent organic matter. The subsoil of the Shelby soil is low in available phosphorus and medium or high in available potassium. The subsoil of the Adair soil is very low in available phosphorus and very low or low in available potassium.

These soils are used mostly for pasture, hay, and row crops. They have fair potential for hay and pasture, fair to poor potential for cultivated crops and trees, and fair to poor potential for most engineering uses.

These soils are moderately to poorly suited to corn, soybeans, and small grains. They are moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of erosion, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage reduce erosion. But even with all these conservation practices, the rate of soil loss is too great for intensive cultivation. In some places this unit is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of these soils for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the level of organic matter of this moderately eroded soil. Pasture management of this area can be difficult on the upper side slopes because the Adair soil is seepy during the spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This complex is in capability subclass IVe.

122—Sperry silt loam, 0 to 1 percent slopes. This nearly level, very poorly drained or poorly drained soil is in slight depressions on broad upland divides and is subject to ponding. Areas are irregular in shape and range from 4 to 10 acres or more.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is dark gray silt loam about 10 inches thick. The subsoil is about 32 inches thick. The upper part is dark gray, mottled, very firm silty clay loam. The middle part is grayish brown, firm silty clay and silty clay loam; and the lower part is light brownish gray, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some places the surface layer is silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Taintor soils that are on the higher areas between the depressions. Taintor soils have more clay in the surface layer and less clay in the subsoil than the Sperry soil and are easier to drain.

This Sperry soil has slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in the spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has fair potential for cultivated crops, fair to good potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains. It is moderately to well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not satisfactory, but in places surface drains can be used to remove excess water. This soil warms slowly in spring and drys slowly after rains. In years when rainfall is heavy, planting is delayed. This soil is fairly difficult to manage and requires timely farming operations. An occasional year of meadow improves tilth and helps to control weeds and insects. If used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability subclass IIIw.

130—Belinda silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on narrow to moderately broad upland divides. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark gray and grayish brown silt loam about 8 inches thick. The subsoil is about 44 inches thick. The upper part is dark grayish brown, mottled, very firm silty clay; the middle part is grayish brown, mottled, very firm silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum to a depth of 75 inches or more is light olive gray, mottled silty clay loam. In some small areas the very dark brown surface layer is about 10 to 12 inches thick or less than 6 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Pershing soils on the more sloping parts of the map unit. Pershing soils are better drained than the Belinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Belinda soil has very slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains. It is moderately to well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided, but tile drains generally are not very satisfactory. Open ditches, surface drainage, landshaping, and bedding are used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. Because this soil is fairly difficult to manage, farming operations need to be timely. An occasional year of meadow improves tilth and helps control weeds and insects. If used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. If areas of this poorly drained soil are planted to trees, the use of equipment needs to be restricted to drier periods or during winter months when the ground is frozen. Because seedlings do not survive well, they should be planted closely together and thinned to achieve the desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting. Erosion is not a limiting factor on this soil during logging and related road construction.

This soil is in capability subclass IIIw.

131B—Pershing silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained or somewhat poorly drained soil is adjacent to narrow to moderately broad flats. It is on convex ridgetops and convex side slopes bordering nearly level, stable, interstream divides in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 47 inches thick. The upper part is dark grayish brown and brown, firm silty clay loam; the middle part is dark grayish brown and grayish brown, mottled, very firm silty clay; and the lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 72 inches or more is light brownish gray, mottled silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Belinda soils that are on the less sloping parts of the map unit and are more poorly drained than the Pershing soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Pershing soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. This soil is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Because natural and planted seedlings do not survive well, they should be planted closely together and thinned to achieve the desired stand density.

This soil is in capability subclass IIIe.

131C—Pershing silt loam, 5 to 9 percent slopes. This moderately sloping, somewhat poorly drained or moderately well drained soil is on convex ridgetops and short, convex side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 60 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 31 inches thick. The upper part is dark grayish brown and yellowish brown, mottled, firm silty clay loam; the middle part is grayish brown and yellowish brown, mottled, very firm silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Armstrong and Rinda soils that are on the lower parts of the side slopes and are seepy during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Pershing soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. This soil is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for hay, pasture, and cultivated crops. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well; therefore, they should be planted closely together and thinned to achieve the desired stand density.

This soil is in capability subclass IIIe.

132B—Weller silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is yellowish brown and dark grayish brown silt loam about 9 inches thick. The subsoil is about 36 inches thick. The upper part is brown, mottled, very firm silty clay; and the lower part is grayish brown and olive gray, mottled, firm silty clay loam. The substratum to a depth of 64 inches or more is grayish brown, mottled silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Beckwith soils that are on the less sloping parts of the map unit and are more poorly drained than the Weller soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. This soil is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, cultivated crops, and woodland. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Also, intensive use for row crops causes the surface layer to puddle after rains and to form a crust on the surface as it dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. It is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but seedlings can be planted closely together and thinned to achieve the desired stand density.

This soil is in capability subclass IIIe.

132C—Weller silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and short, convex side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, very firm silty clay; and the lower part is grayish brown and light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ashgrove and Keswick soils that are on the lower parts of the side slopes and are seepy during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, cultivated crops, and woodland. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Also, intensive use for row crops causes the surface layer to puddle after rains and to form a crust on the surface as it dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but seedlings can be planted closely together and thinned later to achieve the desired stand density.

This soil is in capability subclass IIIe.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on the flood plain and is subject to flooding. Areas are typically long and narrow or irregular in shape and range from 10 to 40 acres or more.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer, extending to a depth of about 39 inches, is very dark gray silty clay loam. The substratum to a depth of 72 inches or more is dark gray silty clay loam. In some places the subsurface layer extends to a depth of only 30 inches.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Zook soils that are in shallow depressions and along drainageways. Zook soils are more difficult to drain than the Colo soil. In some areas of urban construction, the soil has been disturbed by excavation or up to 3 feet of fill material has been added.

This Colo soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is neutral and the reaction of the substratum is neutral or slightly acid. The lower part of the surface layer is medium in available phosphorus and very low in available potassium. The surface layer is 4.5 to 7.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry.

This soil is used for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage and protection against runoff from higher areas can be provided. Drainage is needed to reduce wetness and to provide proper aeration and a deep root zone. Tile drains function satisfactorily in this soil if suitable outlets are obtained. Flooding limits the use of tile drains in low-lying areas. In many places diversion terraces are needed for protection against runoff from higher areas.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land that is susceptible to flooding. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer, extending to a depth of about 48 inches, is very dark gray silty clay loam. The substratum to a depth of 62 inches or more is dark gray silty clay loam. In some places the soil is stratified silty clay loams, and in other areas the upper part of the overwash layer is loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Zook soils that have silty loam overwash and are more difficult to drain than the Colo soil. In some areas of urban construction, this soil has been disturbed by excavation and up to 3 feet of fill material has been added in the low areas.

This Colo soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is slightly acid, unless limed. The lower part of the surface layer is medium in available phosphorus and very low in available potassium. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay below the plow layer.

This soil is used mostly for pasture, hay, and cultivated crops. It has fair potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage and flood protection can be provided. If suitable outlets are obtained, tile drains can function satisfactorily, although adequate drainage is not feasible in the very low areas. In many places diversion terraces are needed for protection against runoff from higher areas.

Pasture management on this poorly drained soil is difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

173—Hoopeston fine sandy loam, 1 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on the low stream terraces. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark brown fine sandy loam about 8 inches thick. The subsurface layer, extending to a depth of about 16 inches, is very dark grayish brown fine sandy loam. The subsoil is dark brown and brown, mottled, very friable fine sandy loam about 24 inches thick. The substratum to a depth of 60 inches or more is multicolored fine sand. In some places the texture of the subsoil is loamy sand or loam. In other areas the subsoil is moderately well drained or well drained and is dark brown to yellowish brown.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Sparta and Waukee soils that are better drained than the Hoopeston soil. In some places the soil has been disturbed by excavation for streets and buildings.

The permeability of this Hoopeston soil is moderately rapid in the subsoil and rapid in the substratum. The available water capacity is moderate, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is low. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 0.5 to 1.5 percent organic matter. It is very friable and very easily tilled. The surface layer warms early in spring and can be worked soon after rains. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture, and fair potential for trees. This soil has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time and the drainage is adequate, but the available water capacity is only moderate. Conservation tillage can be used to help conserve moisture in dry years. An occasional year of meadow improves tilth and helps to control weeds and insects. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. Plowing this soil in fall can subject it to wind erosion. The hazard of wind erosion can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. It can also be greatly reduced by chisel plowing, which leaves crop residue on the surface and helps to conserve moisture.

Pasture management on this droughty soil can be difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is on low stream terraces. Areas are irregular in shape and range from 4 to 20 acres or more.

Typically, the surface layer is very dark brown loam about 10 inches thick. The subsurface layer is very dark brown loam about 8 inches thick. The subsoil, about 20 inches thick, is brown and yellowish brown, friable loam. The substratum to a depth of 60 inches or more is brown loamy coarse sand grading to yellowish brown gravelly sand. In some places the surface layer is sandy loam or fine sandy loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Hoopeston soils in shallow depressions and along drainageways. Hoopeston soils are more poorly drained than the Waukee soil.

The permeability of the Waukee subsoil is moderate, but the permeability of the substratum is very rapid. The available water capacity is moderate, and runoff is medium. The shrink-swell potential is low. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, pasture, and trees. This soil has good potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. Drainage is adequate, but the available water capacity is only moderate. Conservation tillage can be used to help conserve moisture in dry years. An occasional year of meadow improves tilth and helps control weeds and insects. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain better tilth. Plowing this loamy soil in the fall can subject it to wind erosion. The hazard of wind erosion can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. It can also be greatly reduced by chisel plowing, which leaves crop residue on the surface and helps to conserve moisture.

Where this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, and timely deferment of grazing during dry periods help to keep the pasture and soil in good condition.

This soil in in capability subclass IIs.

179E—Gara loam, 14 to 18 percent slopes. This moderately steep, well drained or moderately well drained soil is on convex, narrow ridgetops, nose slopes, and valley side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 40 acres or more.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 72 inches or more is yellowish brown, mottled clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Armstrong and Rinda soils that are on the upper parts of the side slopes, are more poorly drained than the Gara soil, and are seepy during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Gara soil has moderately slow permeability. The available water capacity is high, and runoff is rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. The subsoil is very low or low in phosphorus and very low in available potassium.

This soil is used mostly for hay and pasture. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pastures. It is highly susceptible to erosion. The use of this soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas, but because this soil is moderately steep, the operation of farm machinery can be both difficult and dangerous and needs to be done with caution. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

179E2—Gara loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained or moderately well drained soil is on convex, narrow ridgetops, nose slopes, and valley side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 39 inches thick. The upper part is brown, firm clay loam; the middle part is dark yellowish brown, firm clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 72 inches or more is yellowish brown, mottled clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Armstrong and Rinda soils that are on the upper parts of the side slopes, are more poorly drained than the Gara soil, and are seepy during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Gara soil has moderately slow permeability. The available water capacity is high, and runoff is rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is very low or low in available phosphorus and very low in available potassium.

This soil is used mostly for hay and pasture. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. It is very highly susceptible to further erosion damage. The use of the soil for pasture or hay is effective in controlling erosion. Improved pasture is suitable in some areas of this moderately steep soil. The operation of farm machinery can be both difficult and dangerous and needs to be done with caution. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. If areas of this soil are planted to trees, careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

179F—Gara loam, 18 to 25 percent slopes. This steep, well drained or moderately well drained soil is on convex, narrow nose slopes and valley side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 20 to 100 acres or more.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 29 inches thick. It is yellowish brown, firm clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly yellowish brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Armstrong and Rinda soils that are on the upper side slopes, are more poorly drained than the Gara soil, and are seepy during wet periods. Also included are small areas of the Gara soil that has 25 to 40 percent slopes.

This Gara soil has moderately slow permeability. The available water capacity is high, and runoff is very rapid. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.5 to 2.5 percent organic matter. The subsoil is very low to low in available phosphorus and very low in available potassium.

This soil is used mostly for pasture and wildlife. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has fair potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This steep soil is poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for pasture. It is very highly susceptible to erosion. The use of this soil for pasture is effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and especially, restricted use during wet periods are essential to keep the pasture and soil in good condition. Ordinary farm machinery is both difficult and dangerous to use on these steep slopes.

This soil is suited to trees, and a few small areas remain in native hardwoods. Trees grow best on the northerly and easterly lower slopes and in coves. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

192C2—Adair clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on convex, narrow ridgetops, nose slopes, and side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is more than 53 inches thick. The upper part is brown, firm clay loam; the middle part is brown, very firm clay that has yellowish red mottles; and the lower part is yellowish brown, mottled, firm clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of poorly drained Clarinda soils that are on the upper parts of side slopes and are more poorly drained than the Adair soil.

This Adair soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet it can become hard and cloddy when dry. The subsoil is very low in available phosphorus and very low or low in available potassium. This soil is seepy during wet periods.

This soil is used mostly for hay, pasture, and cultivated crops. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately to poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In many places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once they have been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

192D—Adair silty clay loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained or somewhat poorly drained soil is on convex, narrow ridgetops, nose slopes, and side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown clay loam about 5 inches thick. The subsoil is over 47 inches thick. The upper part is brown, firm clay loam that has red mottles; the middle part is brown, very firm clay that has yellowish red mottles; and the lower part is dark yellowish brown and strong brown, firm clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Clarinda and Shelby soils. Clarinda soils are on the upper parts of the side slopes and Shelby soils are on the lower parts. Clarinda soils are more poorly drained and Shelby soils are better drained than the Adair soil.

This Adair soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table. It is seepy during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 2.5 to 3.5 percent organic matter. The subsoil is very low in available phosphorus and very low or low in available potassium.

This soil is used mostly for hay and pasture. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately to poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe erosion hazard, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage help to reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil, or the regular addition of other organic material improves fertility, helps to maintain better tilth, and increases water infiltration.

The use of this soil for pasture or hay is also effective in controlling erosion. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

192D2—Adair clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained or somewhat poorly drained soil is on convex, narrow ridgetops, nose slopes, and side slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is very dark grayish brown clay loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 48 inches thick. The upper part is brown, firm clay loam; the middle part is dark yellowish brown, very firm clay that has yellowish red mottles; and the lower part is yellowish brown and grayish brown, firm clay loam. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Clarinda and Shelby soils. Clarinda soils are on the upper parts of the side slopes and Shelby soils are on the lower parts. Clarinda soils are more poorly drained and Shelby soils are better drained than the Adair soil.

This Adair soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is slightly acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 1.0 to 3.0 percent organic matter. The subsoil is very low in available phosphorus and very low or low in available potassium.

This soil is used mostly for hay, row crops, and pasture. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately to poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all help to reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of this soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

208—Landes fine sandy loam, 1 to 3 percent slopes. This nearly level, well drained or moderately well drained soil is on the flood plain and is subject to flooding. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is very dark grayish brown and dark brown fine sandy loam about 13 inches thick. The substratum to a depth of 72 inches or more is brown and dark brown loamy fine sand in the upper part and brown sand in the lower part. In some places the surface layer is silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Nodaway and Perks soils occurring throughout the map unit. Nodaway soils contain less sand than the Landes soil, and Perks soils contain more sand. In some places the soil has been disturbed by excavation for streets and buildings.

The permeability of the Landes soil is moderately rapid in the upper part and rapid in the lower part. The available water capacity is low, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is low. The reaction of the surface layer and the subsoil is neutral. The surface layer is 0.5 to 1.5 percent organic matter. It is very friable and very easily tilled. The surface layer warms early in spring and can be worked soon after rains. The substratum is very low in available phosphorus and available potassium.

This soil is used mostly for row crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture, and good potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. The soil is subject to flooding in spring, and it is somewhat droughty in summer. The drainage is adequate, but the available water capacity is low. Conservation tillage can help to conserve moisture. An occasional year of meadow improves tilth and helps to control weeds and insects. Plowing this soil in the fall subjects it to wind erosion, but this erosion can be reduced by leaving a roughened plowed surface and alternative plowed and unplowed strips. It can also be greatly reduced by chisel plowing, which leaves crop residue on the surface and helps to conserve moisture. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

Pasture management can be difficult on this soil that floods or is somewhat droughty. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, restricted use during wet periods, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIs.

211—Edina silt loam, 0 to 1 percent slopes. This nearly level, poorly drained soil is on narrow to broad flats in the loess-covered uplands. Areas are irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray and dark gray silt loam about 13 inches thick. The subsoil is about 29 inches thick. The upper part is dark gray and gray, mottled, very firm silty clay, and the lower part is grayish brown, mottled, very firm silty clay. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Haig soils on the relatively high positions on the landscape between the shallow depressions. Haig soils are easier to drain than the Edina soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Edina soil has very slow permeability. The available water capacity is high, runoff is very low. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is slightly acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for row crops, hay, and pasture. It has fair potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided, but tile drains generally are not satisfactory. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. This soil is difficult to manage and requires timely farming operations. An occasional year of meadow improves tilth and helps control weeds and insects.

When the soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on the flood plain and is subject to flooding. Areas are elongated, narrow, and irregular in shape and range from 10 to 100 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The substratum to a depth of 64 inches or more is stratified dark grayish brown, brown, and grayish brown silt loam. In some places the surface layer is loam, silty clay loam, and sandy loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Colo and Landes soils throughout the map unit. Colo soils are more poorly drained than Nodaway soil, and Landes soils are more droughty than Nodaway soil. Also included are areas of the Nodaway soil that have 10 to 20 inches of sandy loam and loamy sand overwash. In some areas used for urban construction, the soil has been disturbed by excavation and by filling low areas with up to 5 feet of various materials.

This Nodaway soil has moderate permeability. The available water capacity is very high, and runoff is slow. The water table is seasonally high. The shrink-swell potential is moderate. The reaction of the surface layer and substratum is typically neutral. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The substratum is medium in available phosphorus and potassium.

This soil is used primarily for row crops, hay, and pasture. It has good potential for cultivated crops, hay and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate protection from flooding is provided. In many places diversion terraces are needed on adjacent foot slopes to protect this soil against runoff from the higher areas. Returning crop residue to the soil and not tilling when the soil is wet help to maintain good tilth.

Pasture management can be difficult because this soil is subject to flooding. Permanent pastures can be improved by renovating and reseeding. Once the pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and the soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Native and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

222C—Clarinda silty clay loam, 5 to 9 percent slopes. This moderately sloping, poorly drained soil is on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is black silty clay loam about 6 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is more than 62 inches thick. The upper part is very dark gray, firm silty clay; the middle part is dark gray, very firm clay; and the lower part is gray, mottled, very firm clay. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Adair and Colo soils. Adair soils are on the lower parts of the side slopes, and Colo soils are along the drainageways below the side slopes. Adair soils are better drained and Colo soils are easier to drain than the Clarinda soil. Also included in areas where there are Grundy and Arispe soils are Clearfield soils that are on the upper parts of the side slopes and are better drained than the Clarinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clarinda soil has very slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table and is very seepy in some areas during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 2.5 to 3.5 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it can become very hard and cloddy when dry. The subsoil is low in available phosphorus and low or medium in available potassium.

This soil is used mostly for hay, pasture, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a very serious limitation of wetness and a severe hazard of erosion. In many places a narrow, wet, seepy band on the upper part of the side slope remains wet until mid-summer. This soil warms slowly in spring and dries very slowly after rains. In wet years, planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope on the adjacent soil. Row crops can be grown some of the time if adequate drainage and erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Pasture management on this wet and seepy soil is difficult, particularly in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is in capability subclass IVw.

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained soil is on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsoil is over 53 inches thick. The upper part is dark gray, very firm silty clay, and the lower part is gray mottled, very firm clay. In some small, severely eroded areas the surface layer is mostly dark gray silty clay. Generally, plowing has mixed some of the subsoil into the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Adair and Colo soils. Adair soils are on the lower parts of the side slopes, and Colo soils are along the narrow drainageways below the side slopes. Adair soils are better drained and Colo soils are easier to drain than the Clarinda soil. Also included in areas where there are Grundy and Arispe soils are Clearfield soils that are on the upper parts of the side slope and are better drained than the Clarinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clarinda soil has very slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. It is very seepy in some areas during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 2.0 to 3.0 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it can become very hard and cloddy when dry. The subsoil is low in available phosphorus and low or medium in available potassium.

This soil is used mostly for hay, pasture, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If this soil is used for crops, there is both a very serious limitation of wetness and a severe hazard of further erosion damage. In many places this soil has a narrow, wet, seepy band on the upper part of the side slope that remains wet until midsummer. This soil warms slowly in spring and dries very slowly after rains. In wet years, planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope on the adjacent soil. Row crops can be grown some of the time if adequate drainage and erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil needs more nitrogen than the less eroded Clarinda soil and it requires more production inputs to maintain high yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the organic matter content of this moderately eroded soil. Pasture management on this wet and seepy soil is difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is in capability subclass IVw.

223C2—Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, poorly drained or somewhat poorly drained soil is on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways in the uplands. Areas are elongated, narrow, and irregular in shape and range from 4 to 20 acres or more.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer.

The subsoil is about 37 inches thick. The upper part is dark grayish brown, mottled, very firm clay; the middle part is grayish brown, mottled, very firm clay; and the lower part is gray, mottled, very firm clay. The substratum to a depth of 60 inches or more is gray, mottled clay. In some small, severely eroded areas the surface layer is mostly very dark grayish brown clay. In other small areas there is no subsoil mixed with the uneroded surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Armstrong soils that are on the lower parts of the side slopes and are better drained than the Rinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Rinda soil has very slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. It has some very seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it can become very hard and cloddy when dry. The subsoil is low in available phosphorus and low or medium in available potassium.

This soil is used mostly for hay, pasture, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is both a very serious limitation of wetness and a severe hazard of further erosion damage. In many places this soil has a narrow, wet, seepy band on the upper part of the side slope that remains wet until midsummer. This soil warms slowly in spring and dries very slowly after rains. In wet years, planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope on the adjacent soil. Row crops can be grown some of the time if adequate drainage and erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil needs more nitrogen than the less eroded Rinda soil, and requires more production input to maintain high yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the level of organic matter content of this soil. Pasture management on this wet and seepy soil is difficult especially in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is suited to trees. If areas of this poorly drained soil are planted to trees, the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen. Seedlings do not survive well; therefore, they should be planted closely together and thinned later to achieve the desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

223D2—Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained or somewhat poorly drained soil is on short, convex side slopes, convex nose slopes, and in coves at the upper end of drainageways in the uplands. Areas are elongated, narrow, and irregular in shape and range from 4 to 20 acres or more.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some subsoil into it. The subsoil is more than 53 inches thick. The upper part is dark grayish brown, mottled, very firm silty clay; the middle part is grayish brown, mottled very firm clay; and the lower part is gray, mottled, very firm clay. In some small, severely eroded areas the surface layer is mostly very dark grayish brown silty clay. In other small areas there is no subsoil mixed with the uneroded surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Armstrong and Pershing soils. The Armstrong soils are on the lower parts of the side slopes, and the Pershing soils are on the upper parts. These soils are better drained than the Rinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Rinda soil has very slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table, and some areas are very seepy during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it can become very hard and cloddy when dry. The subsoil is low in available phosphorus and low or medium in available potassium.

This soil is used mostly for pasture, hay, and row crops. It has poor potential for cultivated crops, fair to poor potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately to poorly suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is both a very serious limitation of wetness and a very severe hazard of further erosion. In many places this soil has a narrow, wet, seepy band at the upper part of the side slope that remains wet until midsummer. This soil warms slowly in spring and dries very slowly after rains. In wet years, planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope in the adjacent soil. Row crops can be grown some of the time if adequate erosion protection and drainage are provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil needs more nitrogen than the less eroded Rinda soil and requires more production inputs to maintain high yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the organic matter content of this moderately eroded soil. Pasture management on this wet and seepy soil is difficult, especially in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once they have been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is suited to trees. If areas of this poorly drained soil are planted to trees, the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen. Seedlings do not survive well; therefore, they should be planted closely together and thinned later to achieve the desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

230C—Arispe-Clearfield silty clay loams, 5 to 9 percent slopes. This complex consists of moderately sloping, moderately well drained, somewhat poorly drained and poorly drained soils on side slopes and in coves at the heads of drainageways in the loess-covered uplands. It is 60 percent Arispe silty clay loam and about 30 percent Clearfield silty clay loam. The moderately well drained to somewhat poorly drained Arispe soil occupies the upper part of the slopes, and the somewhat poorly drained to poorly drained Clearfield soil occupies the lower part. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Arispe soil is very dark gray silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, mottled, friable silty clay loam; the middle part is grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray and light olive gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light olive gray, mottled silty clay loam. In some small, moderately eroded areas the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly dark grayish brown silty clay loam.

Typically, the surface layer of the Clearfield soil is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark brown and very dark gray silty clay loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part is very dark gray, mottled, friable silty clay loam; the middle part is dark gray, mottled, firm silty clay loam; and the lower part is gray, mottled, firm silty clay loam. The subsoil to a depth of 60 inches or more is gray, mottled clay. In some small areas the depth of the underlying gray clay is about 6 feet.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Clarinda and Colo soils. Clarinda soils are on the lower parts of the side slopes and in the narrow coves at the heads of drainageways. Clarinda soils are more difficult to drain and Colo soils are more poorly drained than Arispe and Clearfield soils. In some places, these soils have been disturbed by excavation for streets and buildings.

The Arispe soil has moderately slow permeability, and the Clearfield soil has very slow permeability. The available water capacity is high for both soils, and runoff is medium. These soils have seasonal high water tables. The shrink-swell potential is also high for both soils. The reaction of the surface layer of both soils is neutral, and the reaction of the subsoil of both soils is medium acid. The surface layer of these soils is 3.0 to 4.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil of both soils is very low or low in available phosphorus and low in available potassium.

These soils are used mostly for row crops, hay, and pasture. They have fair to good potential for cultivated crops, good potential for hay and pasture, and poor potential for trees and for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains, and they are well suited to grasses and legumes for hay and pasture. If these soils are used for crops, there is a severe hazard of erosion, and the lower side slopes need drainage. Row crops can be grown much of the time if adequate erosion protection and drainage are provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places these soils are suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Interceptor tiles in the Arispe soil above the Clearfield soil can prevent seepy spots on the lower side slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of these soils for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when these soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing and, especially, restricted use during wet periods are essential management practices needed to keep the pasture and soil in good condition.

This complex is in capability subclass IIIe.

260—Beckwith silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in flat areas on ridgetops in the loess-covered uplands. Areas are irregular in shape and range from 4 to 40 acres.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is grayish brown and light brownish gray, mottled, very firm silty clay, and the lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 70 inches or more is light brownish gray, mottled silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Weller soils on the more sloping parts of the map unit. Weller soils are better drained than the Beckwith soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Beckwith soil has very slow permeability. The available water capacity is high, and runoff is slow or very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is very strongly acid, unless limed. The surface layer is 1.0 to 2.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils that have less clay in the subsoil. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for row crops, hay, and pasture. It has fair potential for cultivated crops, hay, and pasture, and poor potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and grasses and legumes for hay and pasture. Row crops can be grown some of the time if adequate drainage can be provided, but tile drains generally are not very satisfactory. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. In years when rainfall is heavy, planting is delayed. This soil is fairly difficult to manage, and farming operations need to be timely. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material, improves fertility, helps to maintain tilth, and increases water infiltration.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is suited to trees, and a very few small areas remain in native hardwoods. This soil is poorly drained, and the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen. Natural and planted seedlings do not survive well; therefore, they should be planted closely together and thinned later to achieve the desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIw.

269—Humeston silt loam, 0 to 2 percent slopes. This nearly level, poorly drained or very poorly drained soil is on bottom land and is subject to flooding. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is black and dark gray silt loam about 14 inches thick. The subsoil is about 27 inches thick. The upper part is very dark gray and dark gray, mottled, very firm silty clay, and the lower part is grayish brown, mottled, very firm silty clay. The substratum to a depth of 60 inches or more is olive gray and light olive gray, mottled silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Vesser and Zook soils. Vesser soils occur at random throughout the map unit, and Zook soils are in the low lying areas on the landscape. Vesser soils are easier to drain, and Zook soils are more fertile than the Humeston soil. In some places the soil has been disturbed by excavation for streets and buildings.

The permeability of this Humeston soil is very slow. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 4.0 to 5.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is medium or low in available phosphorus and very low in available potassium.

This soil is used mostly for row crops, hay, and pasture. It has fair potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not satisfactory, and flooding limits their use in the low areas. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when the rainfall is heavy, planting is delayed. This soil is fairly difficult to manage, farming operations must be timely. An occasional year of meadow improves tilth and helps control weeds and insects.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are needed to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

276C2—Ladoga-Hedrick silt loams, 5 to 9 percent slopes, moderately eroded. This complex consists of moderately sloping, moderately well drained soils on convex ridgetops, on upper side slopes, and in coves at the heads of drainageways. It is 60 percent Ladoga silt loam and about 30 percent Hedrick silt loam. The moderately well drained Ladoga soil is on ridgetops and most of the convex side slopes, and the moderately well drained Hedrick soil is in coves at the heads of drainageways and on some of the convex side slopes. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer of the Ladoga soil is very dark grayish brown silt loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into it. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam; the middle part is brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay loam. In some small, severely eroded areas the surface layer is mostly brown silty clay loam.

Typically, the surface layer of the Hedrick soil is very dark grayish brown silt loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into it. The subsoil is about 37 inches thick. The upper part is dark yellowish brown, friable silty clay loam; the middle part is yellowish brown and light olive brown, friable silty clay loam; and the lower part is olive gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is gray, mottled silt loam. In some small, severely eroded areas the surface layer is mostly dark yellowish brown silty clay loam.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Rinda soils. Rinda soils are on the lower side slopes, are more poorly drained than both the Hedrick and Ladoga soils, and are seepy during wet periods.

The permeability of the Ladoga and Hedrick soils is moderate. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer of these soils is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer of these soils is 1.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil of these soils is medium in available phosphorus and very low or low in available potassium.

These soils are used mostly for cultivated crops, hay, and pasture. They have fair to good potential for cultivated crops, and good potential for hay, pasture, and trees. These soils have good to fair potential for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains, and they are well suited to grasses and legumes for hay and pasture. If these soils are used for crops, there is a severe hazard of further erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places these soils are suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. These soils generally need more nitrogen than the less eroded Hedrick and Ladoga soils and require more production input to maintain high yields and to maintain or improve tilth.

The use of these soils for pasture or hay is also effective in controlling erosion. Improved permanent pastures will slowly increase the organic matter content of these moderately eroded soils. Overgrazing or grazing when these soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are suited to trees. If areas of these soils are planted to trees, competing vegetation will need to be controlled by careful site preparation or by spraying or cutting.

This complex is in capability subclass IIIe.

279—Taintor silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad flats in the loess-covered uplands. Areas are irregular in shape and range from 20 to 100 acres or more.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer, extending to a depth of 20 inches, is very dark gray silty clay loam. The subsoil is about 26 inches thick. The upper part is dark gray, mottled, firm silty clay; the middle part is gray, mottled, firm silty clay; and the lower part is gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is gray, mottled silty clay loam. In some small areas the texture of the surface layer is silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Kalona, Mahaska, and Sperry soils. Kalona soils are in flat areas in the center of moderately broad and broad flats. Mahaska soils are on the more sloping parts of the unit, and Sperry soils are in shallow depressions. Kalona soils are more difficult to plow than the Taintor soil. Mahaska soils are better drained and Sperry soils are more poorly drained than the Taintor soil. Sperry soils are more difficult to drain. In some places the soil has been disturbed by excavation for streets and buildings.

This Taintor soil has moderately slow permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is very low in available phosphorus and available potassium.

The soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and poor potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Drainage is needed to reduce wetness and to provide proper aeration and a deep root zone. Tile drains function satisfactorily in this soil, but where there are wide areas of this soil outlets are a problem. This poorly drained soil tends to warm more slowly in spring than better drained soils, and it dries more slowly after rains. Returning crop residue to the soil and avoiding tilling when the soil is wet help to maintain good tilth. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and poor tilth.

This soil is in capability subclass IIw.

280—Mahaska silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on narrow flats and the outward edges of moderately broad to broad flats in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 60 acres or more.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 13 inches thick. The subsoil is about 37 inches thick. The upper part is dark grayish brown, firm silty clay loam, and the lower part is grayish brown, mottled, firm silty clay loam. The substratum to a depth of 70 inches or more is grayish brown, mottled silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Otley, Sperry, and Taintor soils. Otley soils are on the more sloping parts of this unit, Sperry soils are in depressions, and Taintor soils are on small flats. Otley soils are better drained than the Mahaska soil, Sperry soils are more poorly drained and more difficult to drain, and Taintor soils are more poorly drained. In some places the soil has been disturbed by excavation for streets and buildings.

The permeability of this Mahaska soil is moderate. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown most of the time. Drainage generally is adequate on this somewhat poorly drained soil, but in wet years tile drains permit more timely field operations in some of the lower areas.

This soil is used mostly for crops, but sometimes it is used for pasture or hay. When this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability class I.

280B—Mahaska silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is adjacent to broad flats on narrow, convex, upper side slopes and in coves at the heads of drainageways in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is very dark grayish brown, firm silty clay loam; the middle part is grayish brown and olive gray, mottled, firm silty clay loam; and the lower part is olive gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is light olive gray, mottled silt loam. In some small areas the surface layer and the subsurface layer combined are more than 24 inches thick.

Included with this soil in mapping and making up 10 to 15 percent of the unit are small areas of Colo and Nira soils. Colo soils are in narrow drainageways, and Nira soils are on the lower parts of side slopes in the most sloping parts of the unit. Colo soils are more poorly drained than the Mahaska soil and Nira soils are better drained. In some places the soil has been disturbed by excavation for streets and buildings.

This Mahaska soil has moderate permeability. The available water capacity is high, and runoff is slow or medium. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mainly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. This soil is also wet at the heads of drainageways, where field operations are more apt to be timely if tile drains are used. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of this soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

281B—Otley silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is adjacent to broad flats on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm silty clay loam, and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is grayish brown and yellowish brown silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Mahaska soils that are on the less sloping part of the map unit and are more poorly drained than the Otley soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Otley soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for row crops. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

281C—Otley silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 60 acres or more.

Typically, the surface layer is very dark brown silty clay loam about 9 inches thick. The subsurface layer, extending to a depth of about 16 inches, is very dark grayish brown silty clay loam. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, firm silty clay loam, and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is light grayish brown, mottled silty clay loam. In small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Nira soils at the heads of coves and on the lower parts of side slopes. Nira soils have less phosphorus in the subsoil and are grayer in the lower part of the subsoil than the Otley soil. In some places the soil has been disturbed by excavation for streets and buildings.

The permeability of this Otley soil is moderate. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good to fair potential for cultivated crops and good potential for hay, pasture, and trees. This soil has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIIe.

313E—Gosport silt loam, 9 to 18 percent slopes. This moderately well drained soil is on convex side slopes in the uplands. Areas of this strongly sloping and moderately steep soil are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 19 inches thick. The upper part is light olive brown, firm silty clay and the lower part is light olive brown and grayish brown, extremely firm clay. The substratum to a depth of about 60 inches or more is gray, mottled clay shale. In some areas the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly light olive brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of sandstone outcrop and of Douds, Galland, and Lindley soils. The sandstone outcrops occur at random. Douds and Galland soils are on the lower parts of the side slopes, and the Lindley soils are on the upper parts. These soils have a lower content of clay than the shaly Gosport soils. In some places the soil has been disturbed by excavation for streets and buildings.

This Gosport soil has very slow permeability. The available water capacity is low, and runoff is rapid. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is very low in available phosphorus and low in available potassium. This soil is seepy during wet periods.

This soil is used mostly for pasture, woodland, and wildlife. It is not suited to cultivated crops. It has poor potential for hay, pasture, and trees. It has fair to poor potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This soil is poorly suited to grasses and legumes for hay and pasture. It is very highly susceptible to erosion. The use of this soil for pasture or hay is effective in controlling erosion, but hay and pasture management on this shaly soil is difficult. Improved pasture is suitable in some areas but because this soil is strongly sloping or moderately steep, the operation of farm machinery can be both difficult and dangerous and needs to be done carefully.

Permanent pastures can be improved by renovating, liming, and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and many small areas remain in native hardwoods. Natural and planted seedlings do not survive well; therefore, they should be planted closely together to achieve desired stand density. Careful consideration should be given to the location of trails and roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

313E2—Gosport silt loam, 9 to 18 percent slopes, moderately eroded. This moderately well drained soil is on convex side slopes in the uplands. Areas of this strongly sloping and moderately steep soil are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 19 inches thick. The upper part is yellowish brown, firm silty clay; the middle part is brown, extremely firm clay; and the lower part is grayish brown, mottled, extremely firm clay. The substratum to a depth of 60 inches or more is gray, mottled clay shale. In some small, severely eroded areas the surface layer is mostly yellowish brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of sandstone outcrop and of Douds, Galland, and Lindley soils. The sandstone outcrop occurs at random. Douds and Galland soils are on the lower parts of the side slopes, and the Lindley soils are on the upper parts. These soils contain less clay than the shaly Gosport soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Gosport soil has very slow permeability. The available water capacity is low, and runoff is rapid. This soil is seepy during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and low in available potassium.

This soil is used mainly for pasture. This Gosport soil is not suited to cultivated crops. It has poor potential for hay, pasture, and trees. It has fair to poor potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This soil is poorly suited to grasses and legumes for hay and pasture. It is very highly susceptible to further erosion. The use of this soil for pasture or hay is effective in controlling erosion, but hay and pasture management is difficult because the soil is seepy. Improved pasture is suitable in some areas, but because this soil is moderately steep, the operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Permanent pastures can be improved by renovating, liming, and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Planted seedlings will not survive well; therefore, they should be planted closely together to achieve desired stand density. Careful consideration should be given to the location of trails and roads used in logging so that the hazard of erosion can be reduced on the steeper areas. Laying out trails or roads on the contour will reduce soil erosion. Because parts of this area are steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

313F—Gosport silt loam, 18 to 40 percent slopes. This moderately well drained soil is on convex side slopes in the uplands. Areas of these steep and very steep soils are elongated, narrow, and irregular in shape and range from 10 to 80 acres or more.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is grayish brown silty clay loam about 3 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm silty clay; the middle part is light olive brown, extremely firm silty clay; and the lower part is grayish brown, mottled, extremely firm clay. The substratum to a depth of 72 inches or more is gray, mottled clay shale in the upper part and black clay shale in the lower part. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of sandstone outcrop and of Douds, Galland, and Lindley soils. The sandstone outcrop occurs at random. Douds and Galland soils are on the lower parts of the side slopes, and Lindley soils are on the upper parts. These soils contain less clay than the shaly Gosport soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Gosport soil has very slow permeability. The available water capacity is low, and runoff is very rapid. This soil is seepy during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is very low in available phosphorus and low in available potassium.

This soil is used mostly for woodland, pasture, and wildlife. It is not suited to cultivated crops and hay. It has poor potential for pasture and trees. It has fair to poor potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This steep and very steep soil is very highly susceptible to erosion and is not suitable for row crops. It is poorly suited to grasses and legumes for pasture; however, the use of this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition. Good pasture management is difficult on this seepy soil. Ordinary farm machinery is both difficult and dangerous to use on these steep and very steep slopes.

This soil is suited to trees, and many small areas remain in native hardwoods. Natural and planted seedlings do not survive well; therefore, they should be planted closely together and thinned later to achieve the desired stand density. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIIe.

315—Landes-Perks-Nodaway complex, 1 to 3 percent slopes. This complex consists of nearly level soils on flood plains. About 40 percent of this complex is well drained to moderately well drained Landes fine sandy loam, about 30 percent is excessively drained Perks loamy sand, and about 20 percent is moderately well drained Nodaway silt loam. These soils are subject to flooding. Areas are elongated, narrow, and irregular in shape and range from 10 to 60 acres or more. These soils are so intermingled or so small in area that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Landes soil is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown fine sandy loam about 9 inches thick. The substratum to a depth of 60 inches or more is brown loamy fine sand in the upper part and brown sand in the lower part.

Typically, the surface layer of the Perks soil is brown loamy sand about 9 inches thick. The substratum to a depth of 72 inches or more is brown sand in the upper part and dark brown and brown loamy sand in the lower part.

Typically, the surface layer of the Nodaway soil is very dark grayish brown silt loam about 9 inches thick. The substratum to a depth of 60 inches or more is stratified dark grayish brown, very dark grayish brown, and grayish brown silt loam that contains thin strata of sandy loam, loam, and loamy sand below a depth of 44 inches.

Included with this complex in mapping and making up about 10 percent of the unit are small areas of Colo and Zook soils in depressions and along drainageways. Both Colo and Zook soils are more poorly drained and more difficult to drain than the Landes, Perks, and Nodaway soils. In some areas of urban and recreational development, the soils have been disturbed by excavation and 10 feet or more of till material has been added to low spots and stream channels.

The permeability of the Landes soil is moderately rapid in the upper part of the profile and rapid in the lower part. Permeability is rapid in the Perks soil and moderate in the Nodaway soil. The available water capacity is low in the Landes soil, very low in the Perks soil, and very high in the Nodaway soils. The runoff from these soils is slow. The Landes and Nodaway soils have a seasonal high water table. The potential for shrinking and swelling is low in the Landes and Perks soils and moderate in the Nodaway soil.

Except where limed, the surface layer of the Perks soil is medium acid, and that of the Landes and Nodaway soils is neutral. The organic matter content of the surface layer is 0.5 to 1.5 percent in the Landes soil, about 0.5 percent in the Perks soil, and 2.0 to 3.0 percent in the Nodaway soil. The surface layer of the Landes and Perks soils is very friable and very easily tilled—the plow layer warms early in spring and can be worked soon after rains. The surface layer of the Nodaway soil is friable and easily tilled. The substratum is very low in available phosphorus and potassium in the Landes and Perks soils and is medium in the Nodaway soil.

These soils are used mostly for cultivated crops, hay, and pasture. They have fair potential for cultivated crops, hay, and pasture and good to fair potential for trees. They have poor potential for most engineering uses.

These soils are moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. In wet years, they are subject to flooding in spring or the water table is high as a result of the high level of the Des Moines River. This can cause planting to be delayed. Row crops can be grown much of the time.

Crop management is difficult because these soils flood in spring and are droughty in summer. Conservation tillage helps conserve moisture. Plowing these soils in fall permits more timely field operations in spring. It also subjects them to wind erosion, but this can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. Chisel-plowed areas which leave crop residue on the soil surface greatly reduce the hazard of wind erosion. Returning crop residue to the soil or the regular addition of other organic material helps to maintain tilth, improves fertility, and increases water infiltration.

Pasture management is difficult on these soils that flood and are droughty during dry periods. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, proper stocking, pasture rotation, deferment of grazing during dry periods, and restricted use during wet periods are essential to keep the pasture and soils in good condition.

These soils are suited to trees. The seedlings planted on Landes and Nodaway soils will survive and grow well if competing vegetation is controlled or removed. Seedlings planted on Perks soils do not survive well unless they are planted closely together, and later thinned to achieve the desired density in the stand.

This complex is in capability subclass IIIs.

362—Haig silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad flats in the loess-covered uplands. Areas are irregular in shape and range from 40 to 400 acres or more.

Typically, the surface layer is black silt loam about 11 inches thick. The subsurface layer, extending to a depth of about 17 inches, is black silty clay loam. The subsoil is about 38 inches thick. The upper part is very dark gray, firm silty clay loam; the middle part is dark gray and dark grayish brown, mottled, very firm silty clay; and the lower part is olive gray, mottled, firm silty clay loam. The substratum to a depth of 72 inches or more is olive gray, mottled silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Edina and Grundy soils. Edina soils are in shallow depressions, and Grundy soils are on more sloping parts of the map unit. Edina soils are more poorly drained and more difficult to drain than the Haig soil and Grundy soils are better drained. In some places the soil has been disturbed by excavation for streets and buildings.

This Haig soil has slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and subsoil is medium acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and poor potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Drainage is needed to reduce wetness and to provide proper aeration and a deep root zone. Tile drains are not satisfactory on this slowly permeable soil, and surface drains are needed in depressional areas. Where there are wide areas of this soil, outlets are a problem. This soil tends to warm more slowly in spring than better drained soils, and it dries more slowly after rains. Returning crop residue to the soil and avoiding tilling the soil when it is wet help to maintain good tilth. If used for pasture, overgrazing or grazing when the soil is wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

363—Haig silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad flats in the loess covered uplands. Areas are irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer, extending to a depth of about 15 inches, is black silty clay loam. The subsoil is about 38 inches thick. The upper part is very dark gray, firm silty clay; the middle part is olive gray, mottled, very firm silty clay; and the lower part is olive gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is olive gray, mottled silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Edina soils in shallow depressions. Edina soils are more poorly drained and more difficult to drain than the Haig soil.

This Haig soil has slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it is likely to become very hard and cloddy when dry. The subsoil is low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided, but tile drains generally are not very satisfactory. Where there are wide areas of this soil, adequate outlets are a problem. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. This soil is fairly difficult to manage, and farming operations need to be timely. Although plowing in fall helps these farming operations, it subjects the soil to wind erosion. This can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. Erosion can also be reduced by chisel plowing, which leaves crop residue on the surface. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. An occasional year of meadow improves tilth and helps control weeds and insects.

This soil is in capability subclass IIw.

364B—Grundy silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is adjacent to broad flats on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 20 to 80 acres or more.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray and very dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 46 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam; the middle part is dark grayish brown, mottled, very firm silty clay; and the lower part is grayish brown and olive gray, mottled, firm silty clay loam. The substratum to a depth of 86 inches or more is light olive gray, mottled silty clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Arispe and Haig soils. Arispe soils are on the lower side slopes, and Haig soils are on the less sloping parts of the unit. Arispe soils are better drained than the Grundy soil and Haig soils are more poorly drained. In some places the soil has been disturbed by excavation for streets and buildings.

This Grundy soil has slow permeability. The available water capacity is high, and runoff is slow or medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low or low in available phosphorus and low or medium in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. This soil tends to warm more slowly in spring than more permeable soils, and it dries more slowly after rains. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

380B—Mahaska silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is adjacent to broad flats on convex ridgetops and upper side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 41 inches thick. The upper part is very dark grayish brown, firm silty clay loam, and the lower part is grayish brown and light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 72 inches or more is light brownish gray, mottled silt loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Otley soils on the lower side slopes. Otley soils are better drained than the Mahaska soil.

The permeability of this Mahaska soil is moderate. The available water capacity is high, and runoff is slow or medium. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion. Row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

424D2—Lindley-Keswick loams, 9 to 14 percent slopes, moderately eroded. This complex consists of strongly sloping, well drained and moderately well drained soils on short, convex side slopes and convex nose slopes in the uplands. It is about 60 percent Lindley loam and about 30 percent Keswick loam. The well drained Lindley soil is on the lower part of the side slopes, and the moderately well drained Keswick soil is on the upper part. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Lindley soils is dark grayish brown loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is yellowish brown, firm clay loam about 36 inches thick. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown clay loam. In some small, severely eroded areas the surface layer is yellowish brown clay loam. In other small areas that are in pasture or timber, this uneroded soil has a surface layer about 4 inches thick and a grayish brown loam subsurface layer about 5 inches thick.

Typically, the surface layer of the Keswick soil is dark grayish brown loam about 5 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 55 inches thick. The upper part is strong brown, very firm clay that has reddish brown mottles, and the lower part is yellowish brown and grayish brown, mottled, firm clay loam. In some small, severely eroded areas the surface layer is mostly strong brown clay. In other small areas that are in pasture or timber, the uneroded soil has a surface layer about 4 inches thick and a brown loam subsurface layer about 6 inches thick.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Clinton, Douds, Galland, Gosport, and Weller soils. Clinton and Weller soils are on the upper side slopes, and Douds, Galland, and Gosport soils are on the lower side slopes. Clinton and Weller soils have less sand than Keswick and Lindley soils. Douds and Galland soils are more stratified than Keswick and Lindley soils. Galland and Gosport soils are more poorly drained than the Lindley soil, and Gosport soils contain clayey shale. In some places these soils have been disturbed by excavation for streets and buildings.

The Lindley soil has moderately slow permeability, and the Keswick soil has slow permeability. The available water caapacity of both soils is high, and runoff is rapid. The soils on some upper slopes are seepy during wet periods. The Keswick soil has a seasonal high water table. The shrink-swell potential is moderate for the Lindley soil and high for the Keswick soil. The reaction of the surface layer of both soils is medium acid, unless limed, and the reaction of the subsoil of both soils is strongly acid. The surface layer of these soils is 0.5 to 1.5 percent organic matter. The subsoil is low or very low in available phosphorus and very low in available potassium.

These soils are used mostly for pasture, hay, and row crops. They have fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. They have fair to poor potential for most engineering uses.

These soils are moderately suited to poorly suited to corn, soybeans, and small grains, and they are moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on these strongly sloping soils is too great. In some places these soils are suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels on the upper slopes. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of these soils for pasture or hay is also effective in controlling erosion. Improved permanent pasture will slowly increase the organic matter content of these moderately eroded soils. Pasture management on the seepy upper slopes can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are needed to keep the pasture and soil in good condition.

These soils are suited to trees. If they are planted to trees, the seedlings in areas of the Lindley soil should survive if proper species are selected and managed properly, but the seedlings in areas of Keswick soils will not survive well. Seedlings can be planted closely together, however, and thinned later to achieve the desired stand density.

This complex is in capability subclass IVe.

424E—Lindley-Keswick loams, 14 to 18 percent slopes. This complex consists of moderately steep, well drained and moderately well drained soils on short, convex side slopes and convex nose slopes in the uplands. It is 60 percent Lindley loam and about 30 percent Keswick loam. The well drained Lindley soil occupies the lower parts of the side slopes, and the moderately well drained Keswick soil occupies the upper parts. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Lindley soil is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is brown, friable clay loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is grayish brown and yellowish brown clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. Also, in other small, severely eroded areas the surface layer is mostly brown clay loam.

Typically, the surface layer of the Keswick soil is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is more than 50 inches thick. The upper part is brown, firm clay loam; the middle part is brown, very firm clay that has dark reddish brown mottles; and the lower part is strong brown and yellowish brown, mottled, firm clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. Also in other small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this complex in mapping and making up about 10 percent of the unit are small areas of Clinton, Douds, Galland, Gosport, and Weller soils. Clinton and Weller soils are on the upper side slopes, and Douds, Galland, and Gosport soils are on the lower side slopes. Clinton and Weller soils contain less sand, and Douds and Galland soils are more stratified than Keswick and Lindley soils. Galland and Gosport soils are more poorly drained than the Lindley soil. Gosport soils contain clayey shale. In some places these soils have been disturbed by excavation for streets and buildings.

The Lindley soil has moderately slow permeability, and the Keswick soil has slow permeability. The available water capacity of these soils is high, and runoff is rapid. The Keswick soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is moderate for the Lindley soil and high for the Keswick soil. The reaction of the surface layer of both soils is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer of both soils is 1.0 to 2.0 percent organic matter. The subsoil of these soils is low or very low in available phosphorus and very low in available potassium.

These soils are used mostly for pasture, hay, and woodland. They have poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. They have fair to poor potential for most engineering uses.

These soils are poorly suited to corn, soybeans, and small grains, and they are moderately suited to grasses and legumes for hay and pasture. They are very highly susceptible to erosion. The use of these soils for pasture or hay is effective in controlling erosion. Improved pastures are suitable in some areas of these moderately steep soils. Pasture management on the seepy upper slopes can be difficult in spring and early summer. The operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and increases runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition.

These soils are suited to trees, and a few small areas remain in native hardwoods. In areas of the Lindley soil, the survival of seedlings or competition from undesirable plants should not be a problem. In areas of the Keswick soil, natural and planted seedlings do not survive well, however, unless they are planted closely together and thinned later to achieve the desired stand density. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour will reduce soil erosion. Because the slope of these soils is steep, there will be some hazard involved in the operation of equipment. Special equipment can be used, but with caution.

This complex is in capability subclass VIe.

424E2—Lindley-Keswick loams, 14 to 18 percent slopes, moderately eroded. This complex consists of moderately steep, well drained and moderately well drained soils on short, convex side slopes and convex nose slopes in the uplands. It is 60 percent Lindley loam and about 30 percent Keswick loam. The well drained Lindley soil is on the lower parts of the side slopes and the moderately well drained Keswick soil is on the upper parts. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more. These soils are so intermingled or so small in area that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Lindley soil is dark grayish brown loam about 5 inches thick. Generally plowing has mixed some of the subsoil into the surface layer. The subsoil is yellowish brown, firm clay loam about 39 inches thick. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown clay loam. In some small, severely eroded areas the surface layer is mostly yellowish brown clay loam.

Typically, the surface layer of the Keswick soil is dark grayish brown loam about 5 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is more than 55 inches thick. The upper part is yellowish brown, firm clay loam; the middle part is strong brown, very firm clay that has reddish brown mottles; and the lower part is yellowish brown and grayish brown, firm clay loam. In some small, severely eroded areas the surface layer is mostly yellowish brown clay loam.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Clinton, Douds, Galland, Gosport, and Weller soils. Clinton and Weller soils are on the upper side slopes, and Douds, Galland, and Gosport soils are on the lower side slopes. Clinton and Weller soils contain less sand, and Douds and Galland soils are more stratified than Keswick and Lindley soils. Galland and Gosport soils are more poorly drained than the Lindley soil, and Gosport soils contain shaley clay. In some places these soils have been disturbed by excavation for streets and buildings.

The Lindley soil has moderately slow permeability, and the Keswick soil has slow permeability. The available water capacity of both soils is high, and runoff is rapid. The Keswick soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is moderate for the Lindley soil and high for the Keswick soil. The reaction of the surface layer of both soils is medium acid, unless limed, and the reaction of the subsoil is commonly strongly acid. The surface layer of both soils is 0.5 to 1.5 percent organic matter. The subsoil of these soils is low or very low in available phosphorus and very low in available potassium.

These soils are used mostly for pasture and hay. They have poor potential for cultivated crops, fair to poor potential for hay and pasture, and fair potential for trees. They have fair to poor potential for most engineering uses.

These soils are poorly suited to corn, soybeans, and small grains, and they are moderately to poorly suited to grasses and legumes for hay and pasture. They are very highly susceptible to further erosion damage. The use of these soils for pasture or hay is effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of these moderately eroded soils. Pasture management on the seepy upper slopes can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Preparation of the seedbed is difficult. The operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Once the permanent pasture has been established, overgrazing or grazing when the soils are wet causes surface compaction, and increases runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition.

These soils are suited to trees. If areas of these soils are planted to trees, seedlings will not survive well, but they can be planted closely together to achieve desired stand density. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour will reduce soil erosion. Because the slope of these soils is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This complex is in capability subclass VIe.

425D—Keswick loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on short, convex side slopes and convex nose slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more.

Typically, the surface layer is dark grayish brown loam about 4 inches thick. The subsurface layer is brown loam and clay loam about 7 inches thick. The subsoil is over 49 inches thick. The upper part is yellowish brown, firm clay loam; the middle part is strong brown, very firm clay that has reddish brown and yellowish red mottles; and the lower part is yellowish brown, firm clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly yellowish brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Clinton, Lindley, and Weller soils. Clinton and Weller soils are on the upper parts of the side slopes and Lindley soils are on the lower parts. Clinton and Lindley soils are better drained and contain less sand than the Keswick soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Keswick soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table. It has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and woodland. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe erosion hazard, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all help to reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compation, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but they can be planted closely together and thinned later to achieve the desired stand density.

This soil is in capability subclass IVe.

425D2—Keswick loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes and convex nose slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 100 acres or more.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 59 inches thick. The upper part is brown, firm clay loam; the middle part is brown, very firm clay that has reddish brown and red mottles; and the lower part is strong brown yellowish brown, mottled, firm clay loam. The substratum to a depth of 90 inches or more is yellowish brown, mottled clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Clinton, Lindley, and Weller soils. Clinton and Weller soils are on the upper parts of the side slopes, and Lindley soils are on the lower parts. Clinton and Lindley soils are better drained, and Clinton and Weller soils contain less sand than the Keswick soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Keswick soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the level of organic matter of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding (fig. 8). Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings will not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IVe.

451D2—Caleb loam, 7 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on high stream benches. Areas are

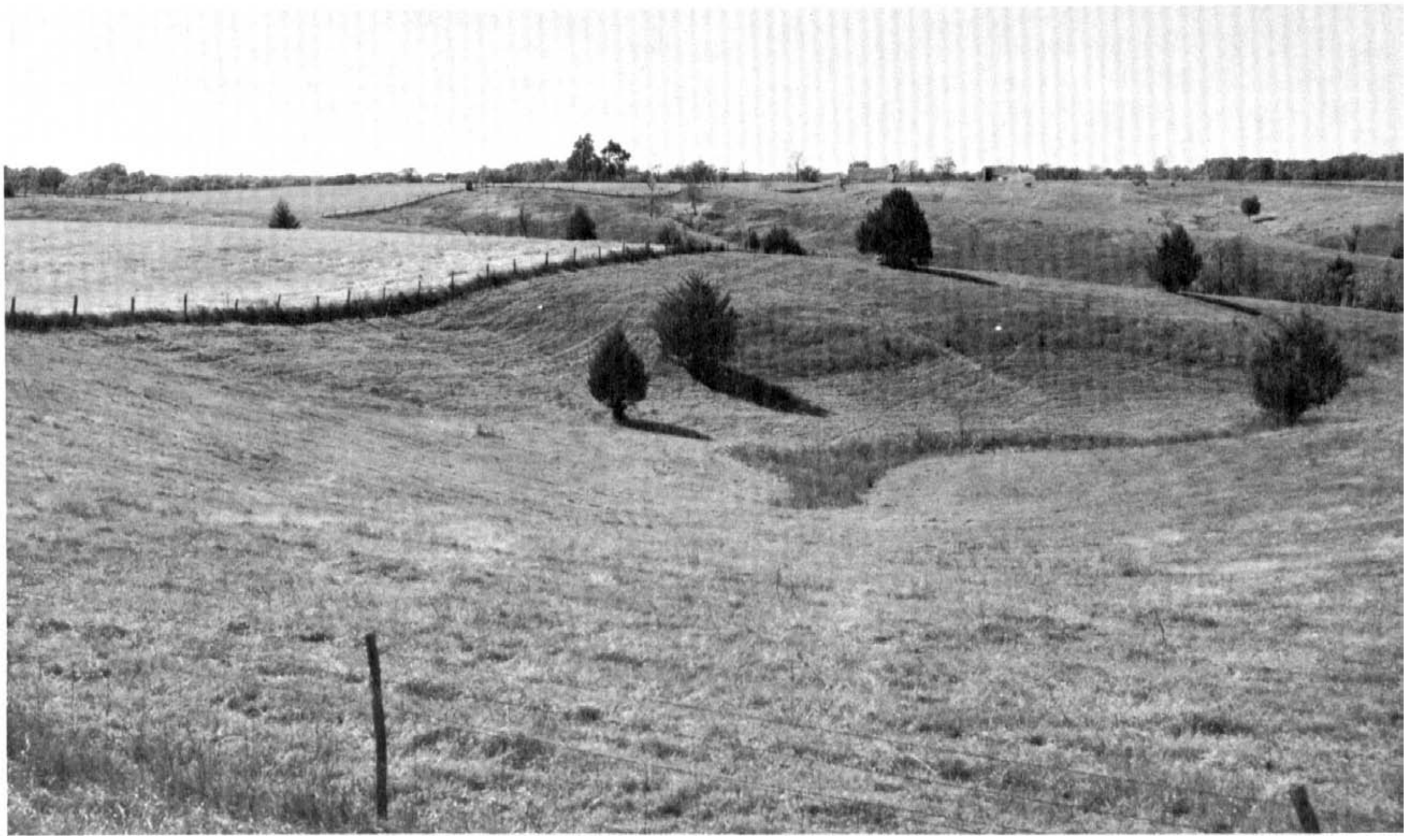

Figure 8.—Improved pasture on Keswick loam, 9 to 14 percent slopes, moderately eroded.

elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 53 inches thick. The upper part is brown, friable clay loam; the middle part is dark yellowish brown and yellowish brown, friable clay loam; and the lower part is yellowish brown and dark yellowish brown, friable sandy loam and sandy clay loam. The substratum to a depth of 72 inches or more is yellowish brown, mottled sandy clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam. In other small areas the surface layer is silty loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ladoga, Mystic, and Pershing soils. The Ladoga and Pershing soils are on the upper parts of the side slopes, and the Mystic soils are on the lower parts. Ladoga and Pershing soils contain less sand and Mystic soils are more poorly drained than the Caleb soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Caleb soil has moderate permeability. The available water capacity is moderate, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture and hay. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has fair to poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and no problems should be encountered if proper species are selected and managed properly.

This soil is in capability subclass IVe.

453—Tuskeego silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land and rarely floods. Areas are irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark gray silt loam and silty clay loam about 10 inches thick. The subsoil is over 42 inches thick. The upper part is dark gray, mottled, firm silty clay loam; the middle part is dark grayish brown and dark gray, mottled, very firm silty clay; and the lower part is grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Coppock, Humeston, and Koszta soils occuring at random throughout the unit. Coppock soils are easier to drain, Humeston soils contain more organic matter, and Koszta soils are better drained than the Tuskeego soil. In some areas used for urban construction the soil has been disturbed by excavation and by filling low areas with up to 3 or more feet of various materials.

The permeability of this Tuskeego soil is very slow. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair potential for cultivated crops, hay, and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not satisfactory on this very slowly permeable soil, and outlets are a problem in areas where the soil is wide and at relatively low-lying elevations. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. Because this soil is fairly difficult to manage, farming operations need to be timely. An occasional year of meadow improves tilth and helps control weeds and insects.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. This soil is poorly drained, and the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen. Natural and planted seedlings do not survive well, but they can be planted closely together and thinned later to achieve the desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIw.

478G—Gosport-Rock outcrop complex, 25 to 40 percent slopes. This complex consists of very steep soils and rock outcrop on bluffs. It is about 50 percent moderately well drained Gosport silt loam and 40 percent Rock outcrop (fig. 9). Areas are elongated, narrow, and irregular in shape and range from 10 to 40 acres or more. Gosport soil and Rock outcrop are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Gosport soil is dark grayish brown silt loam about 5 inches thick. The subsurface layer is brown silty clay loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is yellowish brown, firm silty clay; the middle part is light olive brown, extremely firm clay; and the lower part is grayish brown, mottled, extremely firm clay. The substratum to a depth of 60 inches or more is gray, mottled clay shale. Typically, the Rock outcrop consists of sandstone outcrops. In some small, severely eroded areas the surface layer of the Gosport soil is mostly yellowish brown silty clay. In other small areas adjacent to the sandstone outcrops, the surface layer is sandy loam and the subsoil is loam.

Included with this complex in mapping and making up about 10 percent of the unit are small areas of Lindley soils on the upper parts of the side slopes. Lindley soils have more stable slopes than the Gosport soil. In some places the Gosport soil has been disturbed by excavation for streets and buildings.

This Gosport soil has very slow permeability. The available water capacity is low, and runoff is very rapid.

Figure 9.—Rock outcrop on Gosport-Rock outcrop complex, 25 to 40 percent slopes.

This soil is seepy during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and low in available potassium.

The Gosport soil in this complex is used mostly for woodland, pasture, and wildlife. It is not suitable for cultivated crops. It has poor potential for pasture and trees and poor potential for openland wildlife habitat and woodland wildlife habitat. It has poor potential for most engineering uses.

This very steep Gosport soil is very highly susceptible to erosion and is not suitable for row crops. It is poorly suited to grasses for pasture; however, the use of this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction and increases runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition. On these very steep, rocky slopes, the use of farm machinery is not feasible.

The Gosport soil in this unit is suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution. Natural and planted seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This complex is in capability subclass VIIs.

520—Coppock silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained or poorly drained soil is on low stream benches, foot slopes, and alluvial fans and is subject to flooding. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, grayish brown, and gray silt loam about 12 inches thick. The subsoil, more than 40 inches thick, is grayish brown, mottled, friable silty clay loam. In some small areas the surface layer is about 12 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Koszta and Tuskeego soils occuring throughout the unit. Koszta soils are better drained than the Coppock soil, and Tuskeego soils are more poorly drained and are more difficult to drain. In some places the soil has been disturbed by excavation for streets and buildings.

This Coppock soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not satisfactory on the low-lying bottomland that is subject to flooding. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. Returning crop residue to the soil and avoiding tilling when the soil is wet helps maintain good tilth. If this soil is used for pasture, overgrazing or grazing when the soil is wet can cause surface compaction and result in poor tilth.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation or by spraying or cutting.

This soil is in capability subclass IIw.

570C—Nira silty clay loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is in coves at the heads of drainageways and on convex side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown and grayish brown, firm silty clay loam; and the lower part is light brownish gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is olive gray, mottled silt loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are areas of Mahaska and Otley soils. Mahaska soils are at the heads of drainageways on the less sloping parts of the unit. Otley soils are on the upper parts of the side slopes. Mahaska soils are more poorly drained and Otley soils contain more clay in the subsoil than the Nira soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Nira soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of this soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIIe.

581C2—Otley-Nira silty clay loams, 5 to 9 percent slopes, moderately eroded. This complex consists of moderately sloping, moderately well drained soils on convex ridgetops, on upper side slopes, and in coves at the heads of drainageways in the loess-covered uplands. It is about 50 percent Otley silty clay loam and 40 percent Nira silty clay loam. The moderately well drained Otley soil is on convex ridgetops and convex side slopes, and the moderately well drained Nira soil is in coves at heads of drainageways and on convex side slopes. Areas are elongated, narrow, and irregular in shape and range from 5 to 60 or more acres. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Otley soil is very dark brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into it. The subsoil is more than 53 inches thick. The upper part is brown, firm silty clay loam; the middle part is yellowish brown and brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam.

Typically, the surface layer of the Nira soil is very dark brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into it. The subsoil is about 32 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, mottled, firm silty clay loam; and the lower part is grayish brown and olive gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is olive gray, mottled silty clay loam. In some small, severely eroded areas in both the Nira and Otley soils the surface layer is mostly brown silty clay loam.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Clarinda soils on the lower side slopes. Clarinda soils are more poorly drained than Otley and Nira soils and are seepy during wet periods. In some places these soils have been disturbed by excavation for streets and buildings.

These Otley and Nira soils have moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil of both soils is medium acid, unless limed. The surface layer of both soils is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil of the Otley soil is low in available phosphorus and very low in available potassium. The subsoil of the Nira soil is very low in available phosphorus and available potassium.

These soils are used mostly for cultivated crops, hay, and pasture. They have fair to good potential for cultivated crops and good potential for hay, pasture, and trees. They have good to fair potential for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains, and they are well suited to grasses and legumes for hay and pasture. If these soils are used for crops, there is a severe hazard of further erosion damage. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. These soils generally need more nitrogen than the less eroded Nira and Otley soils and require greater production inputs to maintain high yields and to maintain or improve tilth.

The use of these soils for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of these moderately eroded soils. Overgrazing or grazing when the soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIIe.

592C2—Mystic silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 4 to 20 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 53 inches thick. The upper part is dark yellowish brown, friable clay loam; the middle part is brown, firm clay loam that has dark reddish brown mottles; and the lower part is grayish brown and brown, mottled, friable clay loam. In some small, severely eroded areas the surface layer is mostly dark yellowish brown clay loam. In other small, uneroded areas the surface layer is very dark grayish brown silt loam about 9 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Caleb, Ladoga, and Pershing soils on the upper side slopes. Caleb and Ladoga soils are better drained and Ladoga and Pershing soils contain less sand than the Mystic soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Mystic soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture condition, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and row crops. It has fair potential for cultivated crops, hay, and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent gully erosion. In most places this soil is suited to erosion control practices such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

592D2—Mystic silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 50 inches thick. The upper part is brown, friable clay loam that has reddish brown and yellowish red mottles; the middle part is brown, firm clay loam that has reddish brown and yellowish red mottles; and the lower part is brown, mottled, friable sandy clay loam. The substratum to a depth of 65 inches or more is yellowish brown, mottled sandy clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam. In other small, uneroded areas the surface layer is very dark grayish brown silt loam about 9 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Caleb, Otley, and Pershing soils on the upper parts of the side slopes. Caleb soils are better drained than the Mystic soil, and Otley and Pershing soils are more fertile. In some places the soil has been disturbed by excavation for streets and buildings.

This Mystic soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and row crops. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IVe.

594C2—Galland loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 55 inches thick. The upper part is brown, friable clay loam; the middle part is brown, very firm clay that has dark reddish brown and yellowish red mottles; and the lower part is strong brown and grayish brown, mottled, firm clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam. In other small, uneroded areas the surface layer is dark grayish loam about 5 inches thick, and the subsurface layer is brown loam about 6 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Cantril, Douds, Lindley, and Gosport soils. The Cantril soils are on the lower foot slopes, and the Douds, Lindley, and Gosport soils are on the upper side slopes. Cantril soils are more poorly drained and Douds and Lindley soils are better drained than the Galland soil. Gosport soils are more acid than the Galland soil and contain clayey shale. In some places the soil has been disturbed by excavation for streets and buildings.

This Galland soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table and has seepy spots during wet periods. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is friable and easily tilled under optimum moisture condition, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and row crops. It has fair potential for cultivated crops, hay, and pasture and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. A rotary hoe or other such equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosión. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

594D2—Galland loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well or somewhat poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is brown loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 44 inches thick. The upper part is brown, friable clay loam that has reddish brown and yellowish red mottles; the middle part is brown and yellowish red, firm clay loam; and the lower part is strong brown, friable clay loam grading to strong brown and yellowish brown, friable sandy loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled sandy loam. In some small, severely eroded areas the surface layer is mostly brown clay loam that has reddish brown and yellowish red mottles. In other small, uneroded areas the surface layer is dark grayish brown loam about 4 inches thick and the subsurface layer is brown loam about 6 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Cantril, Douds, Lindley, and Gosport soils. Cantril soils are on the lower foot slopes. Douds, Lindley, and Gosport soils are on the upper parts of the side slopes. Cantril soils are more poorly drained than Galland soils, Douds and Lindley soils are better drained, and Gosport soils are more acid. Gosport soils also contain clayey shale. In some places the soil has been disturbed by excavation for streets and buildings.

This Galland soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. If this soil is used intensively for row crops, the plow layer tends to puddle readily after rains and to form a crust on the surface as it dries. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and cultivated crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

594E2—Galland loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained or somewhat poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 48 inches thick. The upper part is strong brown, firm clay loam that has dark reddish brown and yellowish red mottles, and the lower part is yellowish brown and grayish brown, friable clay loam. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown sandy loam. In some small, severely eroded areas the surface layer is mostly strong brown clay loam that has dark reddish brown and yellowish red mottles. In other small, uneroded areas the surface layer is dark grayish brown loam about 3 inches thick, and the subsurface layer is brown loam about 5 inches thick. Also, in areas adjacent to Gara soils, the surface layer is very dark grayish brown silt loam about 8 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Douds, Lindley, and Gosport soils on the upper side slopes. Douds and Lindley soils are better drained and Gosport soils are more acid than the Galland soil. Gosport soils also contain clayey shale. In some places the soil has been disturbed by excavation for streets and buildings.

This Galland soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture and hay. It has poor potential for cultivated crops and poor potential for hay and pasture. It has fair potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is poorly suited to grasses and legumes for hay and pastures. It is very highly susceptible to further erosion damage.

The use of the soil for pasture or hay is effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Improved pasture is suitable in some areas, but because this soil is moderately steep the operation of farm machinery can be both difficult and dangerous and needs to be done carefully. Permanent pasture can be improved by renovating and reseeding. Preparation of the seedbed is difficult. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction and increases runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting. Careful consideration should be given to the location of trails or roads used in logging on this soil so that the hazard of erosion can be reduced. Laying out trails or roads on the contour will reduce soil erosion. Because the slope of this soil is steep, there will be some hazard involved in the operation of farm equipment. Special equipment can be used, but with caution.

This soil is in capability subclass VIe.

688—Koszta silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low stream terraces and rarely floods. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown and brown, friable silty clay loam; the middle part is dark grayish brown and grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray and light olive gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light olive gray, mottled silty clay loam. In some small areas the surface layer is dark grayish brown or grayish brown, and in other small areas it is silty clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Coppock and Tuskeego soils. Coppock and Tuskeego soils are more poorly drained than the Koszta soil, and Tuskeego soils are more difficult to drain. Also included with this unit is a moderately well drained, moderately permeable soil with slopes of 2 to 5 percent that is better drained than the Koszta soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Koszta soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer is slightly acid, unless limed, and the reaction of the subsoil is medium acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. This soil has poor potential for most engineering uses.

The soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. Drainage generally is adequate on this somewhat poorly drained soil, but in wet years tile drains may be needed in some relatively low areas if field operations are to be timely. Tile drains function satisfactorily, but providing adequate outlets is a problem on bottom land adjacent to the low stream terraces because they are covered with water during wet periods. This land is seldom used for pasture or hay because most of the time it is used for crops. If used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying or cutting.

This soil is in capability class I.

715—Nodaway-Landes complex, 0 to 2 percent slopes. This complex consists of nearly level soils on the flood plain. It is about 60 percent Nodaway silt loam and 30 percent Landes fine sandy loam. The moderately well drained Nodaway soil occupies the outer parts of the areas, and the well drained to moderately well drained Landes soil occupies the central parts along the drainageways. These soils are subject to flooding. Areas are long and narrow. They range from 5 to 80 acres or more. These soils are so intermingled or so small in extent that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Nodaway soil is very dark grayish brown silt loam about 8 inches thick. The substratum to a depth of 60 inches or more is stratified dark brown, brown, and grayish brown silt loam.

Typically, the surface layer of the Landes soil is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown sandy loam about 10 inches thick. The substratum to a depth of 60 inches or more is stratified brown, dark brown, and dark grayish brown sandy loam in the upper part and stratified brown loamy fine sand and dark grayish brown silt loam in the lower part.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Colo and Perks soils. Colo soils are more poorly drained than the Nodaway soil, and Perks soils are more droughty than the Landes soil.

Permeability is moderately rapid in the upper part of the Landes soil and rapid in the lower part. It is moderate in the Nodaway soil. The available water capacity is low for the Landes soil and very high for the Nodaway soil. It is moderate or high in the included Colo and Perks soils. Runoff is slow. Both soils have a seasonal high water table. Both are neutral in the surface layer and substratum. The surface layer of the Landes soil is 0.5 to 1.5 percent organic matter, and that of the Nodaway soil is 2.0 to 3.0 percent. The content of available phosphorus and potassium in the substratum is very low in the Landes soil and medium in the Nodaway soil.

The surface layer of the Landes soil is very friable and very easily tilled. It warms early in spring and can be worked soon after rains. The surface layer of the Nodaway soil is friable and easily tilled. These soils are adjacent to streams and are subject to flooding.

These soils are used mostly for cultivated crops, hay, and pasture. They have fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. They have poor potential for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains and well suited to grasses and legumes for hay and pasture. In wet years, when these soils are subject to spring flooding and the water table is high, planting may be delayed. Row crops can be grown much of the time. Crop management is difficult because these soils are subject to flooding in spring and are droughty in summer. Conservation tillage helps to conserve moisture. Plowing these soils in fall permits more timely field operations in spring but subjects them to wind erosion. The hazard of wind erosion can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. It can also be greatly reduced by chisel-plowing, which leaves crop residue on the surface. Returning crop residue to the soil or the regular addition of other organic material helps to maintain better tilth, improves fertility, and increases water infiltration.

Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, restricted use during wet periods, proper stocking, pasture rotation, and timely deferment of grazing are essential to keep the pasture and soils in good condition.

These soils are suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying or cutting.

This complex is in capability subclass IIIw.

730B—Nodaway-Cantril complex, 2 to 5 percent slopes. This complex consists of gently sloping soils on narrow stream bottoms and narrow foot slopes. It is about 60 percent Nodaway silt loam and 30 percent Cantril loam. The moderately well drained, less sloping Nodaway soil occupies the central parts of the areas along the drainageways, and the somewhat poorly drained Cantril soil occupies the outer parts on the narrow foot slopes adjacent to steeper slopes. Areas are long and narrow and range from 5 to 100 acres or more. These soils are so intermingled or so small in area that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Nodaway soil is very dark gray silt loam about 7 inches thick. The substratum to a depth of 60 inches or more is stratified brown, very dark grayish brown, and grayish brown silt loam.

Typically, the surface layer of the Cantril soil is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is grayish brown and dark yellowish brown, friable loam, and the lower part is dark grayish brown, mottled, friable clay loam. The substratum to a depth of 60 inches or more is dark grayish brown, mottled clay loam. In some small areas on the narrow foot slopes the subsurface layer is very dark grayish brown loam and extends to a depth of about 14 inches.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Colo and Vesser soils. They are on the relatively higher parts of the narrow bottom land with the Nodaway soils, but are more poorly drained than Nodaway soils. In some areas of urban construction, these soils have been disturbed by excavation and 5 feet or more of fill has been added.

The permeability of the Cantril and Nodaway soils is moderate. The available water capacity of the Cantril soil is high and of the Nodaway soil is very high. Runoff is slow or medium. The water table is seasonally high. The shrink-swell potential is moderate.

Except where limed, the Cantril soil is slightly acid in the surface layer and strongly acid in the subsoil, and the Nodaway soil is neutral throughout. The surface layer of both soils is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil of the Cantril soil is low in available phosphorus and potassium, and the substratum of the Nodaway soil is medium.

These soils are used mostly for pasture, hay, woodland, and wildlife habitat. They have fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. They have good potential for openland wildlife habitat and woodland wildlife habitat. These soils have poor potential for most engineering uses.

These soils are moderately suited to corn, soybeans, and small grains, and they are well suited to grasses and legumes for hay and pasture. The narrow bottom land adjacent to steeper side slopes is subject to flooding by runoff from higher areas and by the stream channel. In much of this unit, farming is not feasible. Where row crops are planted, diversion terraces can be used for protection from runoff.

If these soils are used for pasture, overgrazing or grazing when the soils are too wet causes surface compaction and results in poor tilth. Restricted use during wet periods as well as proper stocking, pasture rotation, and timely deferment of grazing keep the pasture and soils in good condition.

These soils are suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting, or girdling.

This complex is in capability subclass IIIw.

731C2—Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained or moderately well drained soil is on convex ridgetops and short convex side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 80 acres or more.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 45 inches thick. The upper part is brown, mottled, firm silty clay loam; the middle part is very dark grayish brown and grayish brown, mottled, very firm silty clay; and the lower part is grayish brown and light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some small, severely eroded areas the surface layer is mostly brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Armstrong and Rinda soils on the lower parts of the side slopes. Seepy spots occur in these soils during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Pershing soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry.

This soil is used mostly for hay, pasture, and cultivated crops. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Pershing soils and requires greater production inputs to maintain higher yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

732C2—Weller silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops, on convex side slopes, and in coves at the heads of drainageways in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 10 to 100 acres or more.

Typically the surface layer is dark grayish brown silty clay loam about 6 inches thick. Generally, plowing has mixed some brown and yellowish brown silty clay subsoil into the surface layer. The subsoil is about 45 inches thick. The upper part is brown, mottled, very firm silty clay; the middle part is brown, mottled, firm silty clay loam; and the lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some small, severely eroded areas the surface layer is mostly brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ashgrove and Keswick soils on the lower parts of the side slopes. Seepy spots occur in these soils during wet periods. Also included are areas on the lower part of side slopes where the lower part of the subsoil is brown clay loam or clay that is more than 20 percent sand. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of subsoil is very strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and cultivated crops. It has fair potential for cultivated crops, hay, pasture, and trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust as the soil dries. This crust retards the emergence of seedlings but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Weller soils and requires greater production inputs to maintain higher yields and to maintain or improve tilth.

The use of the soil for pasture or hay is effective in controlling erosion. Improved permanent pastures slowly increase the level of the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Planted seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

732D2—Weller silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the loess-covered uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically the surface layer is dark grayish brown silty clay loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 44 inches thick. The upper part is brown, mottled, very firm silty clay; the middle part is brown, mottled, firm silty clay loam; and the lower part is grayish brown and light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some small, severely eroded areas the surface layer is mostly brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ashgrove and Keswick soils on the lower parts of side slopes. Ashgrove and Keswick soils have seepy spots during wet periods. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. If it is used intensively for row crops, the plow layer tends to puddle readily after rains and to form a crust as it dries. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and cultivated crops. It has fair potential for cultivated crops, hay, pasture, and trees. It has poor potential for most engineering uses.

This soil is moderately suited to poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage will all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Weller soils and requires greater production inputs to maintain higher yields and to maintain or improve tilth.

The use of this soil for pasture or hay is effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IVe.

779—Kalona silty clay loam, 0 to 1 percent slopes. This nearly level, poorly drained soil is on broad flats on loess-covered upland divides. Areas are irregular in shape and range from 5 to 100 acres or more.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is very dark gray, firm silty clay; the middle part is dark gray, mottled, firm silty clay; and the lower part is olive gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is olive gray, mottled silt loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Sperry and Taintor soils. Sperry soils are in shallow depressions, and Taintor soils are on the more sloping parts of this unit. Sperry soils are more poorly drained than the Kalona soil and are more difficult to drain, and Taintor soils are easier to plow than the Kalona soil.

This Kalona soil has moderately slow permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is neutral. The surface layer is 4.0 to 5.0 percent organic matter. It is easily tilled only under optimum moisture conditions, but if worked when wet, it can become very hard and cloddy when dry. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and poor potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Drainage is needed to reduce wetness and to provide proper aeration and a deep root zone. Tile drains function satisfactorily, but where there are wide areas of this soil, outlets are a problem. In some depressed areas, surface drains are needed to supplement tile drainage. This soil warms more slowly in spring than better drained soils and dries more slowly after rains. Returning crop residue to the soil and avoiding tilling the soil when it is wet helps to maintain good tilth. If this soil is used for pasture, overgrazing or grazing when the soil is wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIw.

792C2—Armstrong loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on short, convex side slopes; narrow, convex ridgetops; and convex nose slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is firm clay loam about 44 inches thick. The upper part is brown with reddish brown and yellowish red mottles; the middle part is dark yellowish brown with dark red mottles; and the lower part is yellowish brown. The substratum to a depth of 84 inches or more is yellowish brown clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam that has reddish brown and yellowish red mottles. In other small, uneroded areas the surface layer is very dark grayish brown loam about 9 inches thick.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Gara, Pershing, Rinda, and Weller soils. Gara soils are on the lower side slopes, and Pershing, Rinda, and Weller soils are on the upper side slopes. Gara soils are better drained than the Armstrong soil, Pershing and Weller soils contain less sand, and Rinda soils are more poorly drained. In some places the soil has been disturbed by excavation for streets and buildings.

This Armstrong soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table and has seepy spots during wet periods. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for hay, pasture, and cultivated crops. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. This soil has poor potential for most engineering uses.

This soil is moderately suited to poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If this soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In many places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

792D—Armstrong loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained or somewhat poorly drained soil is on short, convex side slopes; narrow, convex ridgetops; and convex nose slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 50 inches thick. The upper part is brown, friable clay loam; the middle part is strong brown and grayish brown, very firm clay that has dark reddish brown mottles; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 68 inches or more is yellowish brown, mottled clay loam. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer. In other small, severely eroded areas the surface layer is mostly brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Gara, Pershing, Rinda, and Weller soils. Gara soils are on the lower side slopes, and Pershing, Rinda, and Weller soils are on the upper side slopes. Gara soils are better drained than the Armstrong soil, and Pershing and Weller soils contain less sand. Rinda soils are more poorly drained than the Armstrong soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Armstrong soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for hay and pasture. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to poorly suited to corn, soybeans, and small grains. It is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe erosion hazard, but row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IVe.

792D2—Armstrong loam, 9 to 14 percent slopes, moderately eroded. This soil is strongly sloping and moderately well drained or somewhat poorly drained. It is on short, convex side slopes; narrow, convex ridgetops; and convex nose slopes in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 80 acres or more.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 37 inches thick. The upper part is dark yellowish brown, firm clay loam; the middle part is brown, firm clay loam that has yellowish red mottles; and the lower part is strong brown, mottled, firm clay loam. The substratum to a depth of 81 inches or more is yellowish brown, mottled clay loam. In some small, severely eroded areas, the surface layer is mostly dark yellowish brown clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Gara, Pershing, Rinda, and Weller soils. Gara soils occur on the lower side slopes of the unit, and Pershing, Rinda, and Weller soils are on the upper side slopes. Gara soils are better drained than the Armstrong soil, Pershing and Weller soils contain less sand, and Rinda soils are more poorly drained. In some places the soil has been disturbed by excavation for streets and buildings.

This Armstrong soil has slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table and has seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for hay, pasture, and row crops. It has fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage, but row crops can be grown some of the time if adequate protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IVe.

795D2—Ashgrove silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained or somewhat poorly drained soil is on short, convex side slopes, on convex nose slopes, and in coves at the upper end of the drainageways in the uplands. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is dark grayish brown silty clay loam about 5 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 63 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is gray, very firm clay. In some small, severely eroded areas the surface layer is mostly grayish brown silty clay loam. In other small, uneroded areas the surface layer is dark grayish brown silty clay loam about 9 inches thick. There are also about 160 acres of Ashgrove soils that have slopes of about 7 percent.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Keswick and Weller soils. Keswick soils are on the lower side slopes, and Weller soils are on the upper side slopes. Keswick and Weller soils are better drained than the Ashgrove soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Ashgrove soil has very slow permeability. The available water capacity is moderate and runoff is rapid. This soil has a seasonal high water table. It has very seepy spots during wet periods. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. If this soil is used intensively for row crops, the plow layer tends to puddle readily after rains and to form a crust on the surface as it dries. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and row crops. It has poor potential for cultivated crops, fair to poor potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to poorly suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is both a very serious limitation of wetness and a very severe hazard of further erosion damage. In many places this soil has a narrow, wet, seepy band on the upper part of the side slope that remains wet until midsummer. This soil warms slowly in the spring and dries very slowly after rains. In wet years planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope in the adjacent soil. Row crops can be grown some of the time if adequate erosion protection and adequate drainage is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management on this seepy soil is difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely togehter to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting. The use of farm equipment will need to be restricted to drier periods or during winter months when the ground is frozen.

This soil is in capability subclass IVe.

831C2—Pershing silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained or somewhat poorly drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 49 inches thick. The upper part is dark grayish brown, very firm silty clay, and the lower part is grayish brown and yellowish brown, mottled, firm silty clay loam. The substratum to a depth of 72 inches or more is grayish brown, mottled silty clay loam. Stratified, loamy alluvium is at a depth of about 6 feet. In some small, severely eroded areas the surface layer is mostly dark grayish brown silty clay loam or silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Caleb and Mystic soils on the lower parts of the side slopes. The Caleb and Mystic soils contain more sand than the Pershing soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Pershing soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for hay, pasture, and cultivated crops. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, there is a severe hazard of further erosion damage. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Pershing soils and requires greater production inputs to maintain higher yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

832C2—Weller silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 41 inches thick. The upper part is brown, mottled, very firm silty clay; the middle part is yellowish brown, mottled, very firm silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum to a depth of 72 inches or more is grayish brown and yellowish brown, mottled silty clay loam. Stratified, brown, loamy alluvium is at a depth of about 6 feet. In some small, severely eroded areas the surface layer is mostly brown silty clay.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Douds and Galland soils on the lower parts of the side slopes. Douds and Galland soils contain more sand than the Weller soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and cultivated crops. It has fair potential for cultivated crops, hay, pasture, and trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage water can occur in the terrace channels. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth. This soil generally needs more nitrogen than the less eroded Weller soils and requires greater production inputs to maintain higher yields and to maintain or improve tilth.

The use of the soil for pasture or hay is effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

876B—Ladoga silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces that are adjacent to narrow to moderately broad flats. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable silty clay loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is yellowish brown and grayish brown silty clay loam. Stratified, loamy alluvium is at a depth of about 8.5 feet.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Givin soils that are on the less sloping parts of this unit. Givin soils are more poorly drained than the Ladoga soil.

This Ladoga soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If this soil is used for crops, there is a moderate hazard of erosion, but row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIe.

876C—Ladoga silt loam, benches, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on high, loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 33 inches thick. The upper part is brown, friable silty clay loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 60 inches or more is olive gray, mottled silty clay loam. Stratified, loamy alluvium is at a depth of about 7 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Mystic soils that are on the lower parts of the side slopes. Mystic soils contain more sand than the Ladoga soil.

This Ladoga soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. However, row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suitable for erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

876C2—Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 47 inches thick. The upper part is brown, friable silty clay loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum, to a depth of about 72 inches, is yellowish brown, mottled silt loam. Stratified loamy alluvium is at a depth of about 6 feet. In some small, severely eroded areas the surface layer is mostly brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Mystic soils that are on the lower parts of the side slopes. Mystic soils contain more sand than the Ladoga soil.

This Ladoga soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees (fig. 10). It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage, but row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used,

Figure 10.—Windbreak around farmstead on Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded.

cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil generally needs more nitrogen than the less eroded Ladoga soils and requires greater production inputs to maintain high yields and to maintain or improve tilth.

The use of this soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of the moderately eroded soil. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if proper species are selected and managed properly. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

880B—Clinton silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper part is brown, friable silty clay loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of 76 inches or more is yellowish brown, mottled silty clay loam. Stratified, loamy alluvium is at a depth of about 8 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of somewhat poorly drained soils that have a grayer subsoil and are more poorly drained than the Clinton soil. These somewhat poorly drained soils are on the less sloping parts of this map unit. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.5 to 2.5 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grains. It is well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time but there is a moderate hazard of erosion. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain better tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIe.

880C—Clinton silt loam, benches, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on the loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 10 inches thick. The subsoil is about 47 inches thick. The upper part is brown, friable silty clay loam; the middle part is yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum, to a depth of about 84 inches, is yellowish brown, mottled silty clay loam. Stratified, loamy alluvium is at a depth of about 7 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Douds and Galland soils on the lower side slopes. Douds and Galland soils contain more sand than the Clinton soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, pasture, and woodland. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. However, row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Intensive use for row crops will cause the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

880C2—Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on the loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 50 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. Generally, plowing has mixed some subsoil into the surface layer. The subsoil is about 56 inches thick. The upper part is brown, friable silty clay loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 78 inches or more is grayish brown and yellowish brown silt loam. Stratified, loamy alluvium is at a depth of about 6.5 feet. In some small, severely eroded areas the surface layer is mostly brown silty clay loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Douds and Galland soils and other areas of the Clinton soil that has 9 to 14 percent slopes. Douds and Galland soils are on the lower side slopes and contain more sand than the Clinton soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Clinton soil has moderately slow permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 0.5 to 1.5 percent organic matter. It is friable and easily tilled. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of further erosion damage, but row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil generally needs more nitrogen than the less eroded Clinton soils and requires greater production inputs to maintain high yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pasture slowly increases the organic matter content of this moderately eroded soil. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Hardwood seedlings, however, grow more satisfactorily on uncultivated soil. Conifers are better suited than hardwoods to eroded or formerly cultivated soils. Seedlings survive and grow well if proper species are selected and managed properly. Competing vegetation will need to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

881B—Otley silty clay loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and convex side slopes in loess-covered stream terraces. It is adjacent to moderately broad flats. Areas are elongated, narrow, and irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is black and very dark brown silty clay loam about 13 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm silty clay loam; the middle part is yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of 70 inches or more is grayish brown, mottled silty clay loam. Brown, stratified, loamy alluvium is at a depth of about 7.5 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Mahaska soils on the less sloping parts of the map unit. Mahaska soils are more poorly drained than the Otley soil.

This Otley soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 3.0 to 4.0 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for row crops. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If this soil is used for crops, there is a moderate hazard of erosion, but row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

881C2—Otley silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is about 55 inches thick. The upper part is brown, firm silty clay loam, and the lower part is yellowish brown and grayish brown, friable silty clay loam. The substratum to a depth of 72 inches or more is grayish brown, mottled silt loam. Brown, stratified, loamy alluvium is at a depth of about 8 feet. In some small, severely eroded areas the surface layer is mostly brown silty clay loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Caleb, Mystic, and Mystic Variant soils on the lower side slopes. Caleb, Mystic, and Mystic Variant soils contain more sand than the Otley soil. Mystic and Mystic Variant soils are also more poorly drained than the Otley soil and can be seepy during wet periods.

This Otley soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good to fair potential for cultivated crops and good potential for hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If this soil is used for crops, there is a severe hazard of further erosion damage. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. This soil generally needs more nitrogen than the less eroded Otley soils and requires greater production inputs to maintain high yields and to maintain or improve tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

892D2—Mystic Variant silty clay loam, 7 to 12 percent slopes, moderately eroded. This moderately sloping or strongly sloping, somewhat poorly drained or poorly drained soil is on high stream benches. Areas are elongated, narrow, and irregular in shape and range from 5 to 40 acres or more.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 61 inches thick. The upper part is dark grayish brown, mottled, friable clay loam grading to grayish brown, mottled, very firm clay; and the lower part is grayish brown, firm clay loam. In some small, severely eroded areas the surface layer is mostly dark grayish brown clay loam. In other small, uneroded areas the surface layer is very dark grayish brown silty clay loam about 9 inches thick. Also, in some areas it is silt loam or loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Ladoga, Mystic, and Otley soils on the upper parts of the side slopes. Ladoga and Otley soils contain less sand than the Mystic Variant soil and are better drained. Mystic soils are also better drained than the Mystic Variant soil.

This Mystic Variant soil has very slow permeability. The available water capacity is high, and runoff is rapid. This soil has a seasonal high water table. Very seepy spots occur on this soil during wet periods. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 1.0 to 3.0 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for pasture, hay, and row crops. It has poor potential for cultivated crops, fair potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. If this soil is used for crops, there is both a very serious limitation of wetness and a severe hazard of further erosion damage. In many places this soil has a narrow, wet, seepy band on the upper part of the side slope that remains wet until midsummer. This soil warms slowly in spring and dries very slowly after rains. In wet years, planting is delayed. Tile drainage is not feasible on this very slowly permeable soil, but interceptor tile can be placed upslope in the adjacent soil. Row crops can be grown some of the time if adequate erosion protection and adequate drainage are provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on this strongly sloping soil is too great. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. When terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Improved permanent pastures slowly increase the organic matter content of this moderately eroded soil. Pasture management is difficult on this very seepy soil particularly in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting. This soil is poorly drained, and the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen.

This soil is in capability subclass IVe.

977—Richwood silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on very low stream terraces. Areas are irregular in shape and range from 5 to 100 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable silt loam; the middle part is brown, friable silt loam; and the lower part is brown, friable loam. The substratum to a depth of 60 inches or more is brown, mottled loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Colo and Nevin soils. Colo soils are in depressions and along drainageways. Nevin soils are on the less sloping parts of the unit. Colo and Nevin soils are more poorly drained than the Richwood soil. In some places the soil has been disturbed by excavation and the filling of low areas with 3 feet or more of various material used for urban construction.

This Richwood soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. Drainage generally is adequate on this well drained soil.

This soil is seldom used for pasture or hay because mostly it is used for crops. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability class I.

977B—Richwood silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on very low stream terraces. Areas are elongated, narrow, and irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is about 29 inches thick. The upper part is dark brown, friable silt loam, and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of 60 inches or more is stratified yellowish brown and dark yellowish brown silt loam and sandy loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Nevin and Tuskeego soils on the upper side slopes. Nevin and Tuskeego soils are more poorly drained than the Richwood soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Richwood soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, pasture, and trees. It has good to fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If this soil is used for crops, there is a moderate hazard of erosion, but row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth.

This soil is in capability subclass IIe.

993D2—Gara-Armstrong loams, 9 to 14 percent slopes, moderately eroded. This complex consists of strongly sloping, well drained to somewhat poorly drained soils on short, convex side slopes; narrow, convex ridgetops; and convex nose slopes in the uplands. It is about 60 percent Gara loam and about 30 percent Armstrong loam. The well drained to moderately well drained Gara soil is on the lower part of slopes, and the moderately well drained to somewhat poorly drained Armstrong soil is on the upper part. Areas are elongated, narrow, and irregular in shape and range from 10 to 50 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Gara soil is very dark grayish brown loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is firm clay loam about 41 inches thick. The upper part is brown; the middle part is dark yellowish brown; and the lower part is yellowish brown. The substratum to a depth of 60 inches or more is yellowish brown, mottled clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam. In other small, uneroded areas the surface layer is very dark grayish brown loam about 9 inches thick with a dark grayish brown loam subsurface layer about 4 inches thick.

Typically, the surface layer of the Armstrong soil is very dark grayish brown loam about 7 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil is over 53 inches thick. The upper part is brown, very firm clay that has dark reddish brown and yellowish red mottles; the middle part is strong brown, firm clay loam that has dark reddish brown and yellowish red mottles; and the lower part is yellowish brown and grayish brown, firm clay loam. In some small, severely eroded areas the surface layer is mostly brown clay with dark reddish brown and yellowish red mottles. In other small, uneroded areas the surface layer is very dark grayish brown loam about 8 inches thick with a dark grayish brown loam subsurface layer about 3 inches thick.

Included with these soils in mapping and making up about 10 percent of the unit are small areas of Pershing, Rinda, and Weller soils on the upper slopes. Pershing and Weller soils contain less sand than Armstrong and Gara soils, and Rinda soils are more poorly drained. In some places these soils have been disturbed by excavation for streets and buildings.

This Gara soil has moderately slow permeability, and the Armstrong soil has slow permeability. The available water capacity of both soils is high, and runoff is rapid. The shrink-swell potential is moderate for the Gara soil and high for the Armstrong soil. The Armstrong soil has a seasonal high water table, and it is sometimes seepy during wet periods. The reaction of the surface layer of both soils is medium acid, unless limed, and the reaction of the subsoil of both soils is strongly acid. The surface layer of both soils is 1.0 to 3.0 percent organic matter. The subsoil of these soils is low or very low in available phosphorus and very low in available potassium.

These soils are used mostly for pasture, hay, and row crops. They have fair to poor potential for cultivated crops, fair potential for hay and pasture, and fair potential for trees. They have fair to poor potential for most engineering uses.

These soils are moderately suited to poorly suited to corn, soybeans, and small grains, and they are moderately suited to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion damage. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices such as terracing, farming on the contour, and conservation tillage all reduce erosion. Intensive cultivation is not possible, because the rate of soil loss on these strongly sloping soils is too great. In some places these soils are suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Where terracing is used on the upper slopes on the Armstrong soil, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Where terracing is used on the lower slopes on the Gara soil, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of these soils for pasture or hay is also effective in controlling erosion. Improved permanent pasture slowly increases the organic matter content of these moderately eroded soils. Pasture management on the seepy upper slopes can be difficult in spring and early summer. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soils are wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soils in good condition.

These soils are suited to trees, and there should be no problem in planting seedlings in areas of the Gara soil if proper species are selected and managed properly. Seedlings planted in areas of the Armstrong soil will not survive well, but they can be planted closely together to achieve desired stand density.

This complex is in capability subclass IVe.

1075B—Givin silt loam, benches, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on convex ridgetops and convex side slopes on high, loess-covered stream terraces. Areas are irregular in shape and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 44 inches thick. The upper part is dark grayish brown and brown, friable silty clay loam; the middle part is dark grayish brown and grayish brown, mottled, firm silty clay loam; and the lower part is light brownish gray, mottled, friable silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray, mottled silt loam. Stratified, loamy alluvium is at a depth of about 8 feet.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of moderately well drained Ladoga soils on the narrow, convex ridgetops. In some places the soil has been disturbed by excavation for streets and buildings.

This Givin soil has moderate permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 2.5 to 3.5 percent organic matter. It is friable and easily tilled. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. If the soil is used for crops, there is a moderate hazard of erosion, but row crops can be grown most of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the subsoil. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

The use of the soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

1130—Belinda silt loam, benches, 0 to 2 percent slopes. This nearly level, poorly drained soil is on narrow to moderately broad flats on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark gray and gray silt loam about 9 inches thick. The subsoil is about 43 inches thick. The upper part is dark grayish brown, mottled, very firm silty clay; the middle part is grayish brown, mottled, very firm silty clay; and the lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 96 inches or more is light brownish gray, mottled silty clay loam. Stratified, grayish brown, loamy alluvium is at a depth of about 8 feet. In some small areas the surface layer is very dark gray silt loam about 10 to 12 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Pershing soils on the more sloping parts of the unit. Pershing soils are better drained than the Belinda soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Belinda soil has very slow permeability. The available water capacity is high, and runoff is very slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is low in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair potential for cultivated crops, good potential for hay and pasture, and poor potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains. It is moderately suited to well suited to grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not very satisfactory on this very slowly permeable soil. Open ditches, surface drainage, landshaping, and bedding are all used to remove surface water. This soil warms slowly in the spring and dries slowly after rains. In years when rainfall is heavy, planting is delayed. This soil is fairly difficult to manage and requires timely farming operations. An occasional year of meadow improves tilth and helps control weeds and insects. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings do not survive well, but they can be planted closely together to achieve desired stand density. Competing vegetation will need to be controlled by site preparation or by spraying or cutting. This soil is poorly drained, and the use of equipment will need to be restricted to drier periods or during winter months when the ground is frozen.

This soil is in capability subclass IIIw.

1131B—Pershing silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained or somewhat poorly drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 54 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam; the middle part is grayish brown and yellowish brown, very firm silty clay; and the lower part is light brownish gray, mottled, firm silty clay loam. The substratum to a depth of 84 inches or more is light brownish gray, mottled silt loam. Stratified yellowish and light brownish gray, loamy alluvium is at a depth of about 7 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Belinda soils on the less sloping parts of the map unit. Belinda soils are more poorly drained than the Pershing soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Pershing soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is medium acid, unless limed, and the reaction of the subsoil is strongly acid. The surface layer is 2.0 to 3.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is high in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops, hay, and pasture. It has fair to good potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

1132B—Weller silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridgetops and convex side slopes on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 10 acres or more.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; the middle part is yellowish brown, mottled, very firm silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum, to a depth of 72 inches, is yellowish brown and light brownish gray silty clay loam. Stratified, yellowish brown, loamy alluvium is at a depth of about 6 feet. In some small, moderately eroded areas some of the subsoil is mixed with the surface layer.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Beckwith soils on the less sloping parts of the map unit. Beckwith soils are more poorly drained than the Weller soil. In some places the soil has been disturbed by excavation for streets and buildings.

This Weller soil has slow permeability. The available water capacity is high, and runoff is medium. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer is strongly acid, unless limed, and the reaction of the subsoil is very strongly acid. The surface layer is 1.0 to 2.0 percent organic matter. It is friable and easily tilled under optimum moisture conditions, but in spring it tends to warm and dry more slowly than soils with less clay in the subsoil. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for pasture, hay, and cultivated crops. It has fair potential for cultivated crops, good potential for hay and pasture, and fair potential for trees. It has poor potential for most engineering uses.

This soil is moderately suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If the soil is used for crops, there is a severe hazard of erosion. Row crops can be grown much of the time if adequate erosion protection is provided. Conservation tillage is effective in helping to prevent excessive soil loss, and grassed waterways help to prevent gully erosion. In most places, this soil is suited to erosion control practices, such as contouring and terracing, but in some places these practices are difficult because of undulating topography and short slopes. Where terracing is used, cuts should be held to a minimum depth to prevent exposure of the clayey subsoil. Seepage can occur in the terrace channels. Intensive use for row crops causes the surface layer to puddle readily after rains and to form a crust on the surface as the soil dries. This crust retards the emergence of seedlings, but has less effect on crop growth if seedlings have already emerged. This crust is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other such equipment can be used to break the crust. Returning crop residue to the soil or the regular addition of other organic material improves fertility and helps to maintain tilth.

The use of the soil for pasture or hay is also effective in controlling erosion. Permanent pastures can be improved by renovating and reseeding. Overgrazing and grazing when the soil is wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well, but they can be planted closely together to achieve desired stand density.

This soil is in capability subclass IIIe.

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on undulating bottom land. It is adjacent to meandering stream channels along the major streams in the county. This soil is dissected by many old stream channels that are filled with water part of the time. It is subject to flooding. Areas are long and narrow and range from 10 to 100 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The substratum to a depth of 60 inches or more is stratified dark grayish brown, very dark grayish brown, and grayish brown silt loam that contains thin strata of sandy loam and loamy sand. In some places the surface layer is loam, silty clay loam, or sandy loam.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Colo, Landes, Perks, and Zook soils. They occur throughout the map unit. Colo and Zook soils are more poorly drained than Nodaway soil, and Landes and Perks soils are more droughty. Colo and Zook soils are at relatively lower elevations and Landes and Perks soils are at the higher elevations.

The permeability of this Nodaway soil is moderate. The available water capacity is very high, and runoff is slow. The water table is seasonally high. The shrink-swell potential is moderate. The surface layer and substratum are commonly neutral. The surface layer is 1.5 to 2.5 percent organic matter. The substratum is medium in available phosphorus and potassium.

This soil is used mostly for pasture, hay, woodland, and wildlife habitat. It has poor potential for cultivated crops, fair potential for hay and pasture, and poor potential for trees. It has fair potential for openland wildlife habitat and woodland wildlife habitat. This soil has poor potential for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grains, and it is moderately suited to grasses and legumes for hay and pasture. It is susceptible to frequent flooding. Permanent pasture can be improved by renovating and reseeding. Once the permanent pasture has been established, overgrazing or grazing when the soil is too wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and, especially, restricted use during wet periods are essential to keep the pasture and soil in good condition.

This soil is suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by careful site preparation or by spraying, cutting or girdling. Except for frequent flooding, there are no other hazards or limitations to planting or harvesting trees.

This soil is in capability subclass Vw.

1279—Taintor silty clay loam, benches, 0 to 2 percent slopes. This nearly level, poorly drained soil is on moderately broad flats on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is black silty clay loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is very dark grayish brown, mottled, firm silty clay; the middle part is dark gray, mottled, firm silty clay; and the lower part is olive gray, mottled, firm silty clay loam. The substratum to a depth of 80 inches or more is olive gray, mottled silty clay loam. Stratified, gray, loamy, alluvium is at a depth of about 8 feet.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Colo, Mahaska, and Sperry soils. Colo soils are along drainageways. Mahaska soils are on the more sloping parts of the unit, and Sperry soils are in depressions. Colo soils are more poorly drained than the Taintor soil, Mahaska soils are better drained, and Sperry soils are more poorly drained. Sperry soils are more difficult to drain.

This Taintor soil has moderately slow permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is high. The reaction of the surface layer and the subsoil is slightly acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is easily tilled under optimum moisture conditions, but if worked when wet, it can become hard and cloddy when dry. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and poor potential for trees. It has poor potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time if adequate drainage can be provided. Drainage is needed to reduce wetness and to provide proper aeration and a deep root zone. Tile drains function satisfactorily in this soil. This poorly drained soil tends to warm more slowly in spring, and it dries more slowly after rains. Returning crop residue to the soil and avoiding tilling the soil when it is wet help to maintain tilth. If this soil is used for pasture, overgrazing or grazing when the soil is wet can cause surface compaction and poor tilth.

This soil is in capability subclass IIe.

1280—Mahaska silty clay loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on narrow flats and the outward edges of moderately broad flats on loess-covered stream terraces. Areas are irregular in shape and range from 5 to 20 acres or more.

Typically, the surface layer is black silty clay loam about 13 inches thick. The subsoil is about 41 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam; the middle part is dark grayish brown and grayish brown, mottled, firm silty clay loam; and the lower part is grayish brown, mottled, friable silty clay loam. The substratum to a depth of 63 inches or more is grayish brown, mottled silty clay loam. Stratified, grayish brown, loam alluvium is at a depth of about 8 feet.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Otley, Sperry, and Taintor soils. Otley soils are on the more sloping parts of this unit, Sperry soils are in depressions, and Taintor soils are in small flats. Otley soils are better drained than the Mahaska soil. Sperry and Taintor soils are more poorly drained than the Mahaska soil and Sperry soils are more difficult to drain. In some places the soil has been disturbed by excavation for streets and buildings.

This Mahaska soil has moderate permeability. The available water capacity is high, and runoff is slow. This soil has a seasonal high water table. The shrink-swell potential is moderate. The reaction of the surface layer and the subsoil is medium acid, unless limed. The surface layer is 3.5 to 4.5 percent organic matter. It is friable and easily tilled. The subsoil is medium in available phosphorus and very low in available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, and pasture and fair potential for trees. It has fair potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time. Drainage generally is adequate on this somewhat poorly drained soil, except in wet years when tile drains may be beneficial for timely field operations in some low areas.

This soil is seldom used for pasture or hay because most of the time it is used for crops. When this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability class I.

1315—Landes-Perks complex, channeled, 1 to 3 percent slopes. This complex consists of nearly level, moderately well drained to excessively drained soils on undulating bottom land adjacent to meandering major streams. It is about 50 percent Landes fine sandy loam and 30 percent Perks loamy sand. These soils are dissected by many old stream channels that are filled with water a good part of the time. The well drained to moderately well drained Landes soil occupies the outer parts of the areas, and the excessively drained Perks soil occupies the central parts along the drainageways and old stream channels. Areas are long and narrow and range from 10 to 100 acres or more. These soils are so intermingled, or so small in area, that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Landes soil is very dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 8 inches thick. The substratum to a depth of 60 inches or more is stratified brown, dark brown, and dark grayish brown loamy fine sand, sand, and loamy sand.

Typically, the surface layer of the Perks soil is dark brown loamy sand about 7 inches thick. The substratum to a depth of 60 inches or more is stratified brown, dark brown, and yellowish brown loamy sand and sand.

Included with these soils in mapping and making up about 20 percent of the unit are small areas of Colo, Nodaway, and Zook soils in low areas, shallow depressions, and along drainageways. Colo, Nodaway, and Zook soils are higher in available water capacity, more poorly drained, and more difficult to drain than Landes and Perks soils.

The permeability of the Landes soil is moderately rapid in the upper part and rapid in the lower part. The permeability of the Perks soil is rapid. In both soils, the available water capacity is low or very low, and runoff is slow. The Landes soil has a seasonal high water table. The shrink-swell potential of both soils is low. The surface layer of the Perks soil is medium acid, unless limed, and that of the Landes soil is neutral. The surface layer of both soils is 0.5 to 1.5 percent organic matter. The substratum of these soils is very low in available phosphorus and available potassium.

These soils are used mostly for pasture, woodland, and wildlife habitat. They have poor potential for cultivated crops, fair to poor potential for hay and pasture, and good to fair potential for trees. They have fair potential for openland wildlife habitat and woodland wildlife habitat. These soils have poor potential for most engineering uses.

These soils are poorly suited to corn, soybeans, and small grains, and they are moderately suited to poorly suited to grasses and legumes for hay and pasture. During wet periods, especially in the early spring, these soils are subject to flooding, and during dry periods they are droughty. Some areas are used for pasture or hay. Pasture management on these droughty soils can be difficult. Permanent pastures can be improved by renovating and reseeding. Once the permanent pasture has been established, restricted use during wet periods, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, are essential to keep the pasture and soil in good condition. Other areas are used for openland wildlife habitat and woodland wildlife habitat. Much of the vegetation of woodland areas is willows and shrubs.

These soils are suited to trees. Natural and planted seedlings in areas of the Landes soil will survive and grow well if competing vegetation is controlled or removed. Seedlings in areas of the Perks soil will not survive well, but they can be planted closely together and thinned later to achieve desired stand density. Except for frequent flooding, there are no other hazards or limitations.

This complex is in capability subclass Vw.

1977—Richwood Variant loam, 1 to 3 percent slopes. This nearly level, well drained soil is on low to very low stream terraces. Areas are irregular in shape and range from 10 to 30 acres or more.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 14 inches thick. The subsoil is about 27 inches thick. The upper part is very dark grayish brown, friable loam; the middle part is dark brown, friable loam; and the lower part is brown, friable loam. The substratum to a depth of 60 inches or more is dark yellowish brown loam.

Included with this soil in mapping and making up 5 to 15 percent of the unit are small areas of Nevin, Richwood, and Wiota soils. Nevin soils are in shallow depressions and along drainageways, and Richwood and Wiota soils are in small areas throughout the unit. Nevin soils are more poorly drained than the Richwood Variant soil, Wiota soils contain more clay and less sand, and Richwood soils contain less sand.

This Richwood Variant soil has moderate permeability. The available water capacity is high, and runoff is medium. The shrink-swell potential is low. The reaction of both the surface layer and the subsoil is neutral. The surface layer is 2.0 to 3.0 percent organic matter. It is very friable and very easily tilled. The surface layer warms early in spring and can be worked soon after rains. The subsoil is very low in available phosphorus and available potassium.

This soil is used mostly for cultivated crops. It has good potential for cultivated crops, hay, pasture, and trees. It has good potential for most engineering uses.

This soil is well suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. Row crops can be grown much of the time, and drainage is adequate. Returning crop residue to the soil or the regular addition of other organic material improves fertility, helps to maintain tilth, and increases water infiltration. Plowing this loamy soil in fall may subject it to wind erosion, but this can be reduced by leaving a roughened plowed surface and alternating plowed and unplowed strips. Chisel-plowing, which leaves crop residue on the soil surface, greatly reduces the hazard of wind erosion. It also helps to conserve moisture in dry years.

This soil is seldom used for pasture or hay because most of the time it is used for row crops. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth.

This soil is in capability class I.

4000—Urban land, 0 to 2 percent slopes. This unit consists of built up land on nearly level bottom land and low stream terraces. Areas are irregular in shape and range from 40 to 150 acres or more.

This map unit is covered by streets, parking lots, buildings, and other structures that obscure or alter the original soils so that identification is not feasible.

Most areas of this unit are artificially drained through sewer systems, gutters, drainage tile, and, to a lesser extent, surface ditches.

In much of this unit, 2 to 4 feet or more of fill covers the original soil, which is on low bottom land. River levees and upstream reservoirs help prevent seasonal flooding in much of this area.

This map unit is not assigned to a capability group.

5010—Pits, sand and gravel. These are mined pits from which sand and gravel have been removed. Some are open pits that are 20 to 30 feet or more deep. Many of these pits are still in operation, but they are inactive in areas where the commercial sand and gravel have been removed. Areas are irregular in shape and range from 5 to 20 acres or more.

The soil materials are quite variable, but in general, the permeability is moderately rapid to very rapid, the available water capacity is low, and the shrink-swell potential is low. Reaction ranges from strongly acid to neutral. The soil material is very low in available phosphorus and potassium. Organic matter content is less than 0.5 percent.

Because water accumulates in most of these pits, many that are inactive have been stocked and are used by the public for fishing. Many pits on private property are posted.

This map unit is not assigned to a capability group.

5020—Pits-dumps complex, mines. This complex consists of abandoned Pits and dumps from which coal has been mined. The Pits are the open, trench-type that are 40 feet or more deep. The dumps consist of piles of extremely acid, carbonaceous spoil material that are from 15 to 30 feet high. The Pits and dumps remain barren or nearly barren of vegetation (fig. 11). Water accumulates in most of the Pits, but it is generally too acid for fish. Idle land between or adjacent to the Pits and dumps is eventually vegetated by annual weeds, grasses, and trees after the mining has been completed. Areas are irregular in shape and range from 5 to 20 acres or more.

The soil materials and slopes vary considerably from area to area. In general the permeability is slow or very slow, the available water capacity is moderate or high, and the shrink-swell potential is high. Runoff ranges from medium to very rapid depending upon the slopes. Reaction ranges from strongly acid to extremely acid. This soil material is low in available phosphorus and potassium and is less than 0.5 percent organic matter.

Figure 11.—Barren mine pits and dumps in Pits-dumps complex, mines.

These areas have been abandoned and remain useless. Reclaiming them does not seem to be economically feasible, although some areas may be reclaimed for crop production.

This map unit is not assigned to a capability group.

5030—Pits, limestone quarry. These are mined areas from which limestone has been removed. Some are open pits 20 to 60 feet or more deep. One large pit is still being quarried, and a few smaller pits are in operation. Most remain inactive. Areas are irregular in shape. They range from 4 to 10 acres or more.

These open Pits commonly are filled with water, and many are stocked with fish. Most of the inactive quarries are on private land and are posted.

This map unit is not assigned to a capability group.

6313—Orthents, shaly substratum, 2 to 8 percent slopes. This unit consists of soil materials that have been removed from the upper 4 to 16 feet of gently sloping or moderately sloping, narrow ridgetops and spread over the adjacent side slopes (fig. 12). This broadening and flattening of the ridgetops has made large urban areas available as homesites and sites for commercial buildings and parking lots. Areas are irregular in shape and range from 5 to 50 acres or more.

The ridgetops originally consisted of about 8 to 10 feet of yellowish brown, mottled silty clay loam and silt loam over 2 to 4 feet of yellowish brown, mottled clay loam and loam. Below this was gray clay shale. The soil materials of this unit vary according to the depth of excavation and to their location within the fill areas. Typically, an area that has been excavated to about 15 feet has a center of gray clay shale more than 60 inches deep. The outer fill in this area is about 6 to 10 feet of yellowish brown, mottled silty clay loam and silt loam over gray clay shale. The gray clay shale was originally on side slopes that had 9 to 20 percent gradient. In places where the excavation is about 6 feet deep, only the upper layer of the ridgetop is disturbed. The silty clay loam and silt loam materials are spread 2 to 4 feet thick over the original clay loam and loam and clay shale.

Included with this unit in mapping and making up 5 to 10 percent of the unit are old pits and dumps that have been filled.

The permeability of the silty and loamy materials is moderate or moderately slow, and the permeability of the clay shale is very slow. The available water capacity is high or moderate. Runoff is medium. The shrink-swell potential of the silty and loamy materials is moderate, and that of the clay shale is high. The silty material is typically strongly acid, and the clay shale is extremely acid.

This unit has very poor potential for most engineering uses. Many mud slides have occurred in some of these areas, and mobile homes and streets have been damaged. The outer fill areas, where 6 feet or more of silty clay loam and silt loam materials have been placed over clay shale on 9 to 20 percent slopes are very susceptible to mud slides during long wet periods. The clay shale has very slow permeability and restricts drainage, and the wet silty materials have very low strength.

This map unit is not assigned to a capability group.

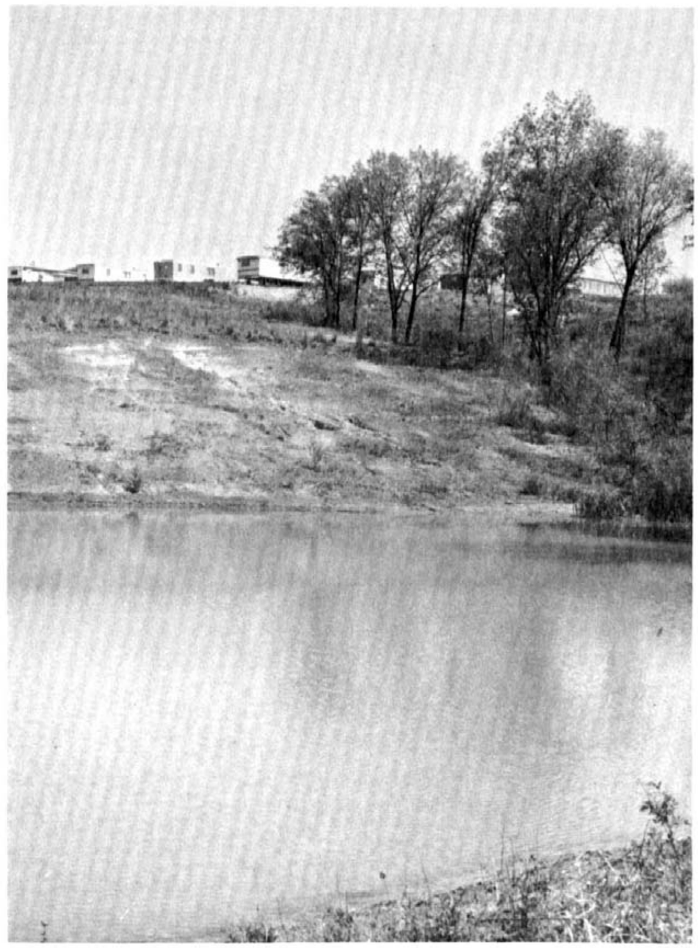

Figure 12.—Exposed shale over disturbed silty material is the foundation of these mobile homes in Orthents, shaly substratum, 2 to 8 percent slopes.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 250,000 acres in the county were used for agricultural purposes in 1976 according to the 1977 Iowa Agricultural Statistics (*4*). Of this total, approximately 109,000 acres were used for row crops, mainly corn and beans; 9,000 acres for close grown crops, mainly oats; 23,000 acres for rotation hay and pasture; 80,000 acres for pasture; and 30,000 acres were used for other purposes.

Food production could be increased by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

More land is being used each year for urban development. Good land use should be based upon the properties and capabilities of soils. The use of this soil survey in helping to make land use decisions on the future role of farming in the county is discussed in the section "General soil map units."

Soil erosion is the major soil problem on about two-thirds of the cropland and pasture in Wapello County. If the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for many reasons. First, productivity is reduced because part of the subsoil is incorporated into the plow layer. This is especially damaging if the subsoil is clayey. In many sloping fields, preparing a good seedbed and tilling are difficult in clayey spots because the original friable surface layer has been eroded away. Clayey spots are common in areas of moderately eroded soils. Erosion also reduces productivity on droughty soils. Where the soil loses its surface layer, sediment enters streams. By controlling erosion, pollution of streams by sediment can be cut to a minimum. Water quality will improve for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

In some areas, slopes are so short, steep, and irregular that contour tillage or terracing is not practical. On these soils cropping systems that provide substantial vegetative cover and conservation tillage are required to control erosion.

Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most tillable soils in the survey area but are more difficult to apply successfully on the eroded soils and the soils that have clayey surface layers. No-tillage, an increasingly popular method for corn and soybeans, is the most effective erosion control practice on continuously cropped land.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most adaptable and practical on well drained, gently sloping to moderately sloping soils that have regular slopes. Terraces and diversions are less suitable for soils that have irregular slopes or are excessively wet or have a clayey subsoil that would be exposed in terrace channels.

Contouring and, less commonly, contour stripcropping are effective as erosion control practices. They are best suited to soils that have smooth, uniform slopes.

Wind erosion is a hazard on sandy soils. It can damage these soils in a few hours if winds are strong and soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes wind erosion.

The Technical Guide, available in local offices of the Soil Conservation Service, has information on methods of erosion control for each kind of soil.

Soil drainage in some areas is the major management problem. Some soils are wet and poorly drained, such as the Beckwith, Belinda, Edina, Haig, Kalona, Sperry, and Taintor soils in the uplands. Other soils along drainageways and on bottom land are poorly drained and include the Colo and Zook soils. Most of these soils become more productive when tiled, but some areas of Beckwith, Belinda, Edina, Haig, Sperry, and Zook soils do not respond well to tiling. Surface drains may be the only practical method of draining some areas of Beckwith, Belinda, Edina, and Zook soils.

Soil fertility is naturally low in many soils in the uplands and most of them are naturally acid. The Colo, Landes, Nodaway, and Zook soils on flood plains are slightly acid to neutral.

Most soils in the uplands are acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for alfalfa and other crops that grow well only on nearly neutral soils. Available potash levels are naturally very low or low in most soils in the uplands. Available phosphorus in the subsoil is high in the timbered Clinton soil but is medium in Ladoga soils and low in Otley soils. On all soils, additions of lime and fertilizer should be based on results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular, generally high in organic matter content, and porous.

Most of the soils used for crops in the survey area have a silt loam or silty clay loam surface layer. Some soils, such as Weller soils, have low organic matter content and form a crust on the surface after an intense rainfall. The crust is hard when dry and hinders water infiltration. Once the crust forms and reduces infiltration, runoff increases rapidly. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce crust formation.

Fall plowing is not a good practice on the light-colored, formerly timbered soils because of the crust that forms during winter and spring. Many soils that have been fall plowed are nearly as dense and hard at the time of planting as they were before they were plowed. Also, about two-thirds of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in fall.

Field crops suited to the soils and climate of Wapello County include many that are not commonly grown. Corn and soybeans are the most common crops. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, canning peas, canning beans, and navy beans can be grown. Oats is the most common close-growing crop. Rye, barley, buckwheat, wheat, and flax could be grown, and grass seed could be produced from bromegrass, redtop, bluegrass, switchgrass, big bluestem, and indiangrass.

Special crops grown commercially in the survey area are limited at present to tomatoes and apples. Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, reduce energy requirements for equipment, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shorebirds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, the ratings provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand and gravel. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated *good* or *fair* has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as not suited as sources of sand and gravel. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 16 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 16 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 8 to 16 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 8 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management.

This table gives for each soil the restrictive features that affect pond reservoir areas; embankments, dikes, and levees; drainage; irrigation; terraces and diversions; and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are considered as a source of material for embankment fill. The site features apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The site features do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as high content of calcium carbonate. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering properties and classifications

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*19*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udoll (*Ud*, meaning humid, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiudolls (*Argi*, meaning argillic horizons, plus *udoll*, the suborder of the Mollisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiudolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Argiudolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*18*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*19*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Adair series

The soils of the Adair series are moderately well drained or somewhat poorly drained and slowly permeable. These soils are on short, convex side slopes and convex nose slopes below the silty, loess-derived soils in the uplands. The Adair soils formed in a Paleosol derived from glacial till under a native vegetation of tall prairie grasses. Slopes range from 5 to 14 percent.

Adair soils are associated on the landscape with Clarinda, Gara, Otley, Nira, and Shelby soils. Clarinda soils contain more clay and have lower chroma in the IIB2 horizon than Adair soils. Gara and Shelby soils contain less clay in the B2 horizon. Otley and Nira soils contain more silt and less clay in the B horizon.

Typical pedon of Adair silty clay loam, 9 to 14 percent slopes, 2,420 feet north and 420 feet west of the southeast corner of section 12, T. 73 N., R. 13 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; slightly acid; clear smooth boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; common fine distinct mottles of brown (7.5YR 4/4); weak fine subangular blocky structure parting to moderate very fine and fine granular; friable; common coatings of very dark gray (10YR 3/1) on peds; few fine segregations (iron oxides) of reddish brown (5YR 4/4) and yellowish red (5YR 4/6); medium acid; gradual smooth boundary.

IIB21t—13 to 19 inches; brown (7.5YR 4/4) clay loam; common fine faint mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/2) and common fine distinct mottles of red (2.5YR 4/6 & 4/8) and reddish brown (2.5YR 4/4); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (2.5YR 4/4), red (2.5YR 4/6 & 4/8), and very dark gray (10YR 3/1); common small pebbles; medium acid; gradual smooth boundary.

IIB22t—19 to 26 inches; brown (7.5YR 4/4) clay; common fine faint mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/2) and common fine and medium distinct mottles of red (2.5YR 4/6 & 4/8), reddish brown (2.5YR 4/4), and yellowish red (5YR 5/6); moderate medium subangular blocky structure; very firm; thin nearly continuous clay films of brown (7.5YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (2.5YR 4/4), red (2.5YR 4/6 & 4/8), and very dark gray (10YR 3/1); common small pebbles; slightly acid; gradual boundary.

IIB31t—26 to 35 inches; dark yellowish brown (10YR 4/4) clay loam; common fine faint mottles of brown (10YR 4/3), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); moderate medium subangular blocky structure; firm; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), yellowish brown (10YR 5/6 & 5/8), and very dark gray (10YR 3/1); common small pebbles; neutral; gradual smooth boundary.

IIB32t—35 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; common fine faint mottles of yellowish brown (10YR 5/4 & 5/6); moderate medium subangular blocky structure; firm; common thin discontinuous clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), yellowish brown (10YR 5/6 & 5/8), and very dark gray (10YR 3/1); common small pebbles; neutral; gradual smooth boundary.

IIB33t—43 to 60 inches; strong brown (7.5YR 5/6) clay loam; common fine faint mottles of yellowish brown (10YR 5/4 & 5/6); moderate medium subangular blocky structure; firm; common thin discontinuous clay films of brown (7.5YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), yellowish brown (10YR 5/6 & 5/8), and very dark gray (10YR 3/1); common small pebbles; neutral.

The solum ranges from 40 to 65 inches in thickness. Thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is clay loam, silty clay loam, or loam. The A horizon is 10 to 20 inches thick and is medium acid or slightly acid, unless limed. The IIB21t horizon ranges from brown (7.5YR 4/4) to yellowish red (5YR 4/6). It is clay or clay loam and is medium acid or strongly acid in reaction. The IIB3t horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) with grayish mottles.

The Adair soils in map units 192C2, 192D2, and 93D2 do not have a mollic epipedon as is defined in the range for the Adair series.

Arispe series

The soils of the Arispe series are moderately well drained or somewhat poorly drained and moderately slowly permeable. These soils are on short, convex side slopes and in coves at the heads of drainageways in the loess-covered uplands. The Arispe soils formed in leached loess under a native vegetation of prairie grasses. Slopes range from 5 to 9 percent.

The Arispe soils are associated on the landscape with Clearfield and Grundy soils and are similar to Nira soils. Clearfield soils are wetter than Arispe soils and have a clayey paleosol at 3 to 5 feet. Grundy soils have more clay in the Bt horizon, and Nira soils have less clay.

Typical pedon of Arispe silty clay loam, 5 to 9 percent slopes, 2,255 feet north and 1,835 feet east of the southwest corner of section 30, T. 71 N., R. 15 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine medium granular structure; friable; neutral; abrupt smooth boundary.

B1—7 to 10 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, gray (10YR 5/1) dry; few fine faint mottles of olive brown (2.5Y 4/4) and strong brown (7.5YR 5/6); strong very fine and fine subangular blocky structure; friable; many coatings of very dark gray (10YR 3/1) on peds; neutral; clear smooth boundary.

B21t—10 to 16 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and olive brown (2.5Y 4/4); strong fine subangular blocky structure; firm; common coatings of very dark gray (10YR 3/1) and very dark grayish brown (2.5Y 3/2) on peds; common thin discontinuous clay films of dark gray (10YR 4/1) and very dark gray (10YR 3/1); common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and black (10YR 2/1); medium acid; gradual smooth boundary.

B22t—16 to 24 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct mottles of olive brown (2.5Y 4/4), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); strong fine subangular blocky structure; firm; common thin discontinuous clay films of grayish brown (2.5Y 5/2), dark gray (10YR 4/1), and very dark gray (10YR 3/1); common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and black (10YR 2/1); medium acid; gradual smooth boundary.

B23t—24 to 30 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct mottles of olive brown (2.5Y 4/4), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of grayish brown (2.5Y 5/2) and dark gray (10YR 4/1); common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to yellowish red (5YR 4/6) and black (10YR 2/1); slightly acid; gradual smooth boundary.

B3t—30 to 39 inches; light olive gray (5Y 6/2) silty clay loam; common fine and medium distinct mottles of yellowish brown (10YR 5/6), olive brown (2.5Y 4/4), and brown (7.5YR 4/4); weak medium subangular blocky structure; firm; few thin patchy clay films of dark grayish brown (2.5Y 4/2), grayish brown (2.5Y 5/2), and dark gray (10YR 4/1); common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to yellowish red (5YR 4/6) and black (10YR 2/1); neutral; gradual smooth boundary.

C1—39 to 48 inches; light olive gray (5Y 6/2) silty clay loam; common fine and medium distinct mottles of strong brown (7.5YR 5/6), olive brown (2.5Y 4/4), and yellowish brown (10YR 5/6); massive; friable; few thin patchy clay films of dark gray (10YR 4/1), very dark gray (10YR 3/1), and dark grayish brown (2.5Y 4/2) in root channels and on vertical faces; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to yellowish red (5YR 4/6) and black (10YR 2/1); neutral; gradual smooth boundary.

C2—48 to 60 inches; light olive gray (5Y 6/2) silty clay loam; common fine and medium distinct mottles of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and yellowish brown (10YR 5/6); massive; friable; few thin patchy clay films of dark gray (10YR 4/1), very dark gray (10YR 3/1), and dark grayish brown (2.5Y 4/2) in root channels and on vertical faces; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to yellowish red (5YR 4/6) and black (10YR 2/1); neutral.

The solum ranges from 36 to 60 inches in thickness. Thickness of the mollic epipedon ranges from 10 to 14 inches.

The Ap or A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick and ranges from neutral to medium acid in reaction. In some areas, a thin A3 horizon is present. The B2t horizon ranges from grayish brown (2.5Y 5/2) or dark grayish brown (2.5Y 4/2) to brown (10YR 4/3 & 5/3). The C horizon ranges from dark grayish brown (2.5YR 4/2) to gray (5Y 6/1). It is neutral or slightly acid in reaction.

The Arispe soil in map unit 23C2 does not have a mollic epipedon as is defined in the range for the Arispe series.

Armstrong series

The soils of the Armstrong series are moderately well drained or somewhat poorly drained and slowly permeable. These soils are on short, convex side slopes; narrow, convex ridgetops; and convex nose slopes in the uplands. The Armstrong soils formed in a Paleosol derived from glacial till under a native vegetation of mixed tall prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

Armstrong soils are associated on the landscape with Gara, Pershing, and Rinda soils and are similar to Adair and Keswick soils. Gara soils have less clay in the B2t horizon than Armstrong soils. Pershing soils have more silt and less sand throughout the solum. Rinda soils have more clay and lower chroma in the B horizon. Adair soils have a mollic epipedon. Keswick soils have a thinner, dark colored A1 horizon or a lighter colored Ap horizon.

Typical pedon of Armstrong loam, 9 to 14 percent slopes, 925 feet south and 1,090 feet east of the northwest corner of section 30, T. 71 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; slightly acid; abrupt smooth boundary.

B1—8 to 10 inches; brown (7.5YR 4/4) clay loam; weak very fine and fine subangular blocky structure; friable; common coatings of dark brown (7.5YR 3/2) and very dark grayish brown (10YR 3/2) on peds; strongly acid; clear smooth boundary.

B21t—10 to 19 inches; strong brown (7.5YR 5/6) clay; common fine distinct mottles of brown (7.5YR 4/4 & 4/2), very dark grayish brown (10YR 3/2), and dark reddish brown (2.5YR 3/4); moderate fine and medium subangular blocky structure; very firm; common thin discontinuous clay films of dark brown (7.5YR 4/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; common fine segregations (iron and manganese oxides) of dark reddish brown (2.5YR 3/4) and strong brown (7.5YR 5/6); strongly acid; clear smooth boundary.

B22t—19 to 24 inches; strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay; common fine distinct mottles of yellowish red (5YR 5/8); few fine distinct mottles of dark reddish brown (2.5YR 3/4) and reddish brown (5YR 4/4); moderate fine and medium subangular blocky structure; very firm; few thin patchy clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/6 & 5/8) and very dark gray (5YR 3/1); strongly acid; gradual smooth boundary.

B23t—24 to 32 inches; strong brown (7.5YR 5/6) clay; common fine distinct mottles of grayish brown (10YR 5/2), yellowish red (5YR 5/8), and reddish brown (5YR 4/4); weak medium subangular blocky structure; very firm; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), yellowish red (5YR 5/8), and very dark gray (5YR 3/1); strongly acid; gradual smooth boundary.

B31t—32 to 44 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct mottles of grayish brown (10YR 5/2); weak medium subangular blocky structure; firm; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish red (5YR 4/6), brown (7.5YR 4/4), and black (10YR 2/1); neutral; gradual smooth boundary.

B32t—44 to 58 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct mottles of brown (10YR 5/2); weak medium and coarse subangular blocky structure; firm; common coatings of light gray (10YR 6/1) and dark brown (7.5YR 4/2) on vertical faces of peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), yellowish red (5YR 4/8), and black (10YR 2/1); neutral; gradual smooth boundary.

C—58 to 68 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct mottles of light gray (10YR 6/1) and grayish brown (10YR 5/2); weak medium and coarse subangular blocky structure; firm; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and black (10YR 2/1); common fine and medium segregations and concretions of calcium carbonate; slight effervescence; moderately alkaline.

The solum ranges from 42 to 80 inches in thickness.

The Ap or A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is loam, silt loam, or clay loam. The A1 or Ap horizon is 7 to 9 inches thick and is medium acid or slightly acid, unless limed. The A2 horizon, if present, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is loam or silt loam and ranges from very strongly acid to slightly acid. The B2t horizon ranges from brown (7.5YR 4/4) to yellowish red (5YR 5/6). It is clay or clay loam and ranges from very strongly acid to medium acid.

Ashgrove series

The soils of the Ashgrove series are poorly drained and somewhat poorly drained and very slowly permeable. These soils are on short, convex side slopes, convex nose slopes, and in coves at the upper end of drainageways in the uplands. The Ashgrove soils formed in a Paleosol derived from glacial till under a native vegetation of deciduous trees. Slopes range from 9 to 14 percent.

Ashgrove soils are associated on the landscape with Keswick, Lindley, and Weller soils and are similar to Clarinda and Rinda soils. Keswick and Lindley soils have less clay and higher chroma in the B horizon than Ashgrove soils. Weller soils have less clay and sand and more silt throughout the solum, and have higher chroma in the B horizon. Clarinda soils have a mollic epipedon. Rinda soils have a thicker, dark colored A1 horizon or darker colored Ap horizon.

Typical pedon of Ashgrove silty clay loam, 9 to 14 percent slopes, moderately eroded, 1,610 feet north and 370 feet west of the southeast corner of section 5, T. 71 N., R. 15 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; some grayish brown (2.5Y 5/2) heavy silty clay loam is mixed into the plow layer; moderate very fine and fine granular structure; friable; medium acid; clear smooth boundary.

IIB1t—5 to 8 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of dark grayish brown (2.5Y 4/2); weak fine subangular blocky structure; firm; common thin discontinuous clay films of dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; clear smooth boundary.

IIB21t—8 to 16 inches; gray (10YR 5/1) clay; common fine faint mottles of dark gray (10YR 4/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of dark gray (10YR 4/1) and gray (10YR 5/1) on peds; medium acid; gradual smooth boundary.

IIB22t—16 to 24 inches; gray (10YR 5/1) clay; common fine faint mottles of dark gray (10YR 4/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of dark gray (10YR 4/1) and gray (10YR 5/1) on peds; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

IIB23t—24 to 33 inches; gray (10YR 5/1 & 6/1) clay; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very firm; thin nearly continuous clay films of gray (10YR 5/1) on peds; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

IIB24t—33 to 42 inches; gray (10YR 6/1) clay; common fine faint mottles of gray (10YR 5/1); moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very firm; thin nearly continuous clay films of gray (10YR 5/1) on peds; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

IIB31t—42 to 58 inches; gray (5Y 6/1) clay; common fine faint mottles of gray (5Y 5/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of gray (10YR 5/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); mildly alkaline; gradual smooth boundary.

IIB32t—58 to 68 inches; gray (5Y 6/1) clay; common fine faint mottles of gray (5Y 5/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of gray (10YR 5/1) on peds; few fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); mildly alkaline.

The solum ranges from 42 to 84 inches in thickness.

The Ashgrove soils have an Ap horizon, but in some areas thin A1 and A2 horizons are present. The A1 horizon, if there is one, ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2) and is only 0 to 4 inches thick. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is silty clay loam or silt loam. The Ap horizon is 5 to 8 inches thick and ranges from very strongly acid to medium acid, unless limed. The IIB2t horizon ranges from gray (10YR 5/1) to pale olive (5Y 6/3). It is very strongly acid to neutral.

Beckwith series

The soils of the Beckwith series are poorly drained and very slowly permeable. These soils are in small, flat areas on ridgetops in the loess-covered uplands. The Beckwith soils formed in leached loess under a native vegetation of deciduous trees. Slopes range from 0 to 2 percent.

Beckwith soils are associated on the landscape with Weller soils and are similar to Belinda and Edina soils. Weller soils have higher chroma in the B2t horizon than Beckwith soils. Belinda soils have a thicker dark colored A1 horizon or darker Ap horizon. Edina soils have a mollic epipedon.

Typical pedon of Beckwith silt loam, 0 to 2 percent slopes, 220 feet south and 800 feet west of the northeast corner of section 36, T. 71 N., R. 14 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, gray (10YR 6/1) dry; weak very fine and fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 15 inches; light gray (10YR 7/2) silt loam; moderate thin platy structure; friable; very strongly acid; abrupt smooth boundary.

B21tg—15 to 19 inches; grayish brown (10YR 5/2) silty clay; common fine faint mottles of brown (10YR 5/3); moderate very fine and fine subangular blocky structure; very firm; common thin patchy clay films of grayish brown (10YR 5/2) on peds; few fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); very strongly acid; gradual smooth boundary.

B22tg—19 to 28 inches; grayish brown (10YR 5/2) silty clay; common fine distinct mottles of yellowish brown (10YR 5/6); weak medium subangular blocky structure; very firm; common thin patchy clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23tg—28 to 36 inches; light brownish gray (10YR 6/2) silty clay; common fine distinct and faint mottles of yellowish brown (10YR 5/6) and grayish brown (10YR 5/2); weak medium subangular blocky structure; very firm; common thin patchy clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B31tg—36 to 46 inches; light brownish gray (10YR 6/2) silty clay loam; common fine faint and distinct mottles of yellowish brown (10YR 5/6) and grayish brown (10YR 5/2); weak medium subangular structure; firm; few thin patchy clay films of grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B32tg—46 to 57 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct and faint mottles of yellowish brown (10YR 5/6) and grayish brown (10YR 5/2); weak medium subangular blocky structure; firm; few thin patchy clay films of grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

Cg—57 to 70 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct and faint mottles of yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and light yellowish brown (2.5Y 6/3); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); neutral.

The solum ranges from 42 to 72 inches in thickness.

The A1 horizon if there is one, ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It is 0 to 5 inches thick and ranges from very strongly acid to medium acid in reaction. The Ap horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). It is 0 to 8 inches thick and ranges from very strongly acid to medium acid, unless limed. The A2 horizon ranges from grayish brown (10YR 5/2) to light gray (10YR 7/2). It is very strongly acid to medium acid in reaction. The B2t horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). It is very strongly acid to medium acid.

Belinda series

The soils of the Belinda series are poorly drained and very slowly permeable. These soils are on narrow to moderately broad upland divides and are on high stream terraces. The Belinda soils formed in leached loess under a native vegetation of mixed grasses and deciduous trees. Slopes range from 0 to 2 percent.

Belinda soils are associated on the landscape with Pershing soils and are similar to Beckwith and Edina soils. Pershing soils have higher chroma than Belinda soils in the Bt horizon. Beckwith soils have a lighter colored Ap horizon or a thinner dark-colored A1 horizon. Edina soils have a mollic epipedon.

Typical pedon of Belinda silt loam, 0 to 2 percent slopes, 2,350 feet north and 1,800 feet west of the southeast corner of section 15, T. 72 N., R. 13 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; slightly acid; abrupt smooth boundary.

A21—8 to 12 inches; dark gray (10YR 4/1) silt loam; moderate thin and medium platy structure; friable; many silt coatings of light gray (10YR 7/1 dry) on peds; strongly acid; clear smooth boundary.

A22—12 to 16 inches; grayish brown (10YR 5/2) silt loam; few fine distinct mottles of dark yellowish brown (10YR 4/4); weak medium platy structure parting to weak medium subangular blocky; friable; many silt coatings of light gray (10YR 7/1 dry) on peds; few fine segregations (iron and manganese oxides) of dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and very dark gray (10YR 3/1); strongly acid; clear smooth boundary.

B21t—16 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine faint mottles of light olive brown (2.5Y 5/4), olive brown (2.5Y 4/4), and grayish brown (2.5Y 5/2); moderate medium prismatic structure parting to strong fine subangular blocky and angular blocky; very firm; thin continuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2); common coatings of very dark gray (10YR 3/1) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); strongly acid; gradual smooth boundary.

B22t—23 to 30 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine faint mottles of light olive brown (2.5Y 5/4), olive brown (2.5Y 4/4), and grayish brown (2.5Y 5/2); moderate medium prismatic structure parting to strong fine subangular blocky and angular blocky; very firm; thin continuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); strongly acid; gradual smooth boundary.

B23t—30 to 36 inches; grayish brown (2.5Y 5/2) silty clay; common fine faint mottles of olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2); moderate medium prismatic structure parting to moderate fine and medium subangular blocky and angular blocky; very firm; thin nearly continuous clay films of dark grayish brown (2.5Y 4/2), very dark grayish brown (2.5Y 3/2), and grayish brown (2.5Y 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B31t—36 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light olive brown (2.5Y 5/4), dark grayish brown (2.5Y 4/2), and light brownish gray (2.5Y 6/2); moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common thin discontinuous clay films of dark grayish brown (2.5Y 4/2), very dark grayish brown (2.5Y 3/2), and grayish brown (2.5Y 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B32t—44 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light olive brown (2.5Y 5/4), dark grayish brown (2.5Y 4/2), and light brownish gray (2.5Y 6/2); weak medium prismatic structure parting to weak medium subangular blocky; firm; few thin patchy clay films of dark grayish brown (2.5Y 4/2), very dark grayish brown (2.5Y 3/2), and grayish brown (2.5Y 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

C—60 to 75 inches; light olive gray (5Y 6/2) silty clay loam; common fine distinct mottles of light olive brown (2.5Y 5/4), dark grayish brown (2.5Y 4/2), and grayish brown (2.5Y 5/2); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); slightly acid.

The solum is 60 inches or more in thickness, and there are no carbonates to an even greater depth.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and ranges from strongly acid to slightly acid, unless limed. The A2 horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2). It ranges from very strongly acid to medium acid. The B2t horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2), and from very strongly acid to medium acid.

Caleb series

The soils of the Caleb series are moderately well drained and moderately permeable. They are on high stream benches. They formed in loamy, stratified, water-sorted glacial sediments deposited as alluvium during an earlier geological period. These soils developed under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 7 to 14 percent.

Caleb soils are associated on the landscape with Gara and Mystic soils and are similar to Douds soils. Gara soils formed in glacial till and do not have stratification throughout their profiles. Mystic soils contain more clay than Caleb soils in the B2t horizon. Douds soils have a thinner dark-colored A1 horizon or a lighter colored Ap horizon.

Typical pedon of Caleb loam, 7 to 14 percent slopes, moderately eroded, 1,180 feet north and 390 feet west of the southeast corner of section 33, T. 71 N., R. 15 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; some dark yellowish brown (10YR 4/4) and brown (10YR 4/3) clay loam is mixed into the plow layer; moderate fine and medium granular structure; friable; neutral; gradual smooth boundary.

B1—7 to 11 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4); weak fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) on peds; few fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B21t—11 to 16 inches; dark yellowish brown (10YR 4/4) clay loam; common fine faint mottles of brown (10YR 4/3); moderate fine and medium subangular blocky structure; friable; common thin discontinuous clay films of brown (10YR 4/3) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B22t—16 to 21 inches; dark yellowish brown (10YR 4/4) clay loam; common fine faint mottles of brown (10YR 4/3); moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of brown (10YR 4/3) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; strongly acid; gradual smooth boundary.

B23t—21 to 29 inches; yellowish brown (10YR 5/4) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of dark yellowish brown (10YR 4/4) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; strongly acid; gradual smooth boundary.

B31t—29 to 36 inches; yellowish brown (10YR 5/4 & 5/6) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8); moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; common thin discontinuous clay films of dark yellowish brown (10YR 4/4) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; strongly acid; gradual smooth boundary.

B32t—36 to 50 inches; yellowish brown (10YR 5/4 & 5/6) sandy loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; common thin discontinuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; medium acid; abrupt smooth boundary.

B33t—50 to 60 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) sandy clay loam; common fine faint mottles of grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4); weak medium subangular blocky structure; friable; few thin patchy clay films of dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/8) and very dark gray (10YR 3/1); few small pebbles; slightly acid; gradual smooth boundary.

C—60 to 72 inches; yellowish brown (10YR 5/4) sandy clay loam; common fine faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); massive; friable; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; neutral.

The solum ranges from 60 to 72 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is loam, silt loam, or clay loam. The A1 or Ap horizon is 7 to 9 inches thick and is strongly acid or medium acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is loam, silt loam, or clay loam and ranges from very strongly acid to medium acid. The B2t horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). It is loam, clay loam, or sandy clay loam and is strongly acid or medium acid.

Cantril series

The soils of the Cantril series are somewhat poorly drained and moderately permeable. They are on slightly concave to straight upland footslopes. They formed in loamy local alluvium derived from glacial till and loess under a native vegetation of mixed prairie grasses and trees. Slopes range from 2 to 5 percent.

Cantril soils are associated on the landscape with Lindley and Nodaway soils. Lindley soils have higher chroma in the B horizon than Cantril soils and have a thinner, lighter colored A1 horizon. Nodaway soils have less clay and sand in the control section.

Typical pedon of Cantril loam, 2 to 5 percent slopes, 460 feet north and 1,170 feet east of the southwest corner of section 14, T. 71 N., R. 13 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; slightly acid; clear smooth boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) loam; weak thick platy structure parting to weak fine subangular blocky; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; few silt coatings of light brownish gray (10YR 6/2 dry) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B1—12 to 17 inches; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) loam; moderate fine and medium subangular blocky structure; friable; common coatings of dark grayish brown (10YR 4/2) on peds; common silt coatings of light gray (10YR 7/2 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B21t—17 to 23 inches; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) clay loam; common fine faint mottles of dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of brown (7.5YR 4/2 & 5/2); common silt coatings of light gray (10YR 7/2 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B22t—23 to 30 inches; dark grayish brown (10YR 4/2) clay loam; common fine faint mottles of grayish brown (10YR 5/2), yellowish brown (10YR 5/6), and brown (7.5YR 4/4); moderate medium subangular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2); common silt coatings of light gray (10YR 7/2 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23t—30 to 39 inches; dark grayish brown (10YR 4/2) clay loam; common fine faint mottles of very dark grayish brown (10YR 3/2) and brown (7.5YR 4/4); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; thin nearly continuous clay films of very dark grayish brown (10YR 3/2); few silt coatings of light gray (10YR 7/2 dry) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B3t—39 to 55 inches; dark grayish brown (10YR 4/2) clay loam; common fine faint mottles of grayish brown (10YR 5/2) and brown (75YR 4/4); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; common thin discontinuous clay films of dark grayish brown (10YR 4/2); common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); common small and medium pebbles; medium acid; gradual smooth boundary.

C—55 to 60 inches; dark brown (10YR 3/3) and dark grayish brown (10YR 4/2) clay loam; common fine faint mottles of brown (10YR 4/3); massive; friable; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); common small and medium pebbles; slightly acid.

The solum ranges from 42 to 60 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is loam or silt loam and ranges from 7 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is loam or silt loam and ranges from strongly acid to slightly acid. The B2t horizon ranges from strongly acid to slightly acid.

Clarinda series

The soils of the Clarinda series are poorly drained and very slowly permeable. These soils are on short, convex side slopes; on convex nose slopes; and in coves at the upper end of drainageways in the uplands. The Clarinda soils formed in a Paleosol derived from glacial till under a native vegetation of prairie grasses. Slopes range from 5 to 9 percent.

Clarinda soils are associated on the landscape with Adair, Arispe, Nira, and Otley soils and are similar to Ashgrove and Rinda soils. Adair soils contain less clay and have higher chroma in the IIB2t horizon than Clarinda soils. Arispe, Nira, and Otley soils contain more silt and less clay and sand and have higher chroma in the B2t horizon. Ashgrove and Rinda soils lack a mollic epipedon.

Typical pedon of Clarinda silty clay loam, 5 to 9 percent slopes, 1,540 feet south and 1,770 feet east of the northwest corner of section 5, T. 71 N., R. 12 W.

Ap—0 to 6 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; neutral; gradual smooth boundary.

A3—6 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium granular structure parting to weak fine subangular blocky; firm; common coatings of black (10YR 2/1) on peds; slightly acid; gradual smooth boundary.

IIB1t—10 to 14 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; few fine distinct mottles of olive gray (5Y 4/2); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of black (10YR 2/1) on peds; slightly acid; gradual smooth boundary.

IIB21tg—14 to 19 inches; dark gray (5Y 5/1) clay; common fine faint mottles of gray (5Y 5/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1) and yellowish brown (10YR 5/6 & 5/8); slightly acid; gradual smooth boundary.

IIB22tg—19 to 24 inches; gray (5Y 5/1) clay; common fine faint mottles of dark gray (5Y 4/1); moderate fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1) and yellowish brown (10YR 5/6 & 5/8); slightly acid; gradual smooth boundary.

IIB23tg—24 to 39 inches; gray (5Y 5/1) clay; common fine distinct mottles of yellowish brown (10YR 5/4 & 5/6); moderate medium subangular blocky structure; very firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1) and yellowish brown (10YR 5/6 & 5/8); neutral; gradual smooth boundary.

IIB24tg—39 to 58 inches; gray (5Y 5/1) clay; few fine distinct mottles of yellowish brown (10YR 5/6); weak medium and coarse prismatic structure parting to moderate medium subangular blocky; very firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1) and yellowish brown (10YR 5/6 & 5/8); few fine and medium segregations and concretions of calcium carbonate; neutral; gradual smooth boundary.

IIB3tg—58 to 72 inches; gray (5Y 5/1) clay; common fine distinct mottles of yellowish brown (10YR 5/6); moderate medium subangular blocky structure; very firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1) and yellowish brown (10YR 5/6 & 5/8); few fine and medium segregations and concretions of calcium carbonate; neutral.

The solum ranges from 48 to more than 72 inches in thickness. The mollic epipedon ranges from 10 to 20 inches thick.

The A horizon is 10 to 16 inches thick and is medium acid or slightly acid, unless limed. It formed in loess or silty sediments ranging from 10 to 18 inches thick, unless eroded. The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1). The IIB2tg horizon is gray (5Y 5/1) or dark gray (5Y 4/1). It is clay or silty clay and ranges from strongly acid to neutral.

The Clarinda soils in map unit 222C2 do not have a mollic epipedon as is defined in the range for the Clarinda series.

Clearfield series

The soils of the Clearfield series are poorly or somewhat poorly drained and very slowly permeable. These soils are on nearly straight to slightly convex side slopes and in coves at the heads of drainageways in the uplands. Clearfield soils formed in 3 1/2 feet of loess underlain by a clayey buried soil. Clearfield soils developed under a native vegetation of prairie grasses. Slopes range from 5 to 9 percent.

Clearfield soils are associated on the landscape with Arispe, Clarinda, and Grundy soils. Arispe and Grundy soils are not as wet as Clearfield soils and lack a clayey paleosol at 3 to 5 feet. Clarinda soils are poorly drained.

Typical pedon of Clearfield silty clay loam in an area of Arispe-Clearfield silty clay loams, 5 to 9 percent slopes, 2,095 feet south and 850 feet west of the northeast corner of section 6, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A12—8 to 12 inches; very dark brown (10YR 2/2) silty clay loam, dark gray (10YR 4/1) dry; few fine faint mottles of very dark grayish brown (10YR 3/2); weak fine subangular blocky structure parting to moderate fine granular; friable; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6) and dark brown (7.5YR 3/2); slightly acid; gradual smooth boundary.

A3—12 to 16 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; common fine distinct mottles of strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4); moderate very fine subangular blocky structure parting to moderate fine granular; friable; many coatings of very dark brown (10YR 2/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B1t—16 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; common fine faint mottles of dark gray (10YR 4/1) and dark grayish brown (10YR 4/2); common fine distinct mottles of light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6); moderate very fine and fine subangular blocky structure; friable; common coatings of dark grayish brown (10YR 4/2) on peds; common thin discontinuous clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B21t—20 to 25 inches; dark gray (5Y 4/1) silty clay loam; common fine faint mottles of olive gray (5Y 4/2); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4); weak medium prismatic structure parting to moderate very fine and fine subangular blocky; firm; thin nearly continuous clay films of dark gray (5Y 4/1) and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); slightly acid; gradual smooth boundary.

B22t—25 to 29 inches; dark gray (5Y 4/1) silty clay loam; common fine faint mottles of olive gray (5Y 4/2 & 5/2) and gray (5Y 5/1); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4); moderate medium prismatic structure parting to moderate fine subangular blocky; firm; thin nearly continuous clay films of dark gray (5Y 4/1) and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); neutral; gradual smooth boundary.

B31t—29 to 34 inches; dark gray (5Y 4/1) silty clay loam; common fine faint mottles of olive gray (5Y 4/2 & 5/2), gray (5Y 5/1), and light olive gray (5Y 6/2); common fine distinct mottles of yellowish brown (10YR 5/6), light olive brown (2.5Y 5/4), and dark brown (7.5YR 4/4); moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous clay films of dark gray (5Y 4/1) and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); neutral; gradual smooth boundary.

B32t—34 to 40 inches; gray (5Y 5/1) silty clay loam; common fine faint mottles of light olive gray (5Y 6/2); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4); moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common thin discontinuous clay films of gray (5Y 5/1), dark gray (5Y 4/1), and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); neutral; clear wavy boundary.

IIBb—40 to 60 inches; gray (5Y 5/1) clay; common fine faint mottles of light gray (5Y 6/1), light olive gray (5Y 6/2), and olive gray (5Y 5/2 & 4/2); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4); moderate coarse prismatic structure parting to moderate medium subangular blocky; very firm; common thin discontinuous clay films of gray (5Y 5/1), dark gray (5Y 4/1), and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); neutral.

The solum above the II material is 3 to 5 feet thick. The mollic epipedon is 10 to 24 inches thick, and the loess overlying a clayey paleosol is 3 to 5 feet thick.

The Ap and A1 horizon ranges from black (10YR 3/1) to very dark grayish brown (10YR 3/2). It is 10 to 16 inches thick and ranges from neutral to medium acid. The B2t horizon ranges from dark gray (10YR 4/1) to olive gray (5Y 5/2) and from medium acid to neutral.

Clinton series

The soils of the Clinton series are moderately well drained and well drained and moderately slowly permeable. These soils are on convex ridgetops and upper side slopes in the uplands and high stream terraces. The Clinton soils formed in leached loess under a native vegetation of deciduous trees. Slopes range from 2 to 14 percent.

Clinton soils are similar to Ladoga, Otley, and Weller soils. Ladoga soils have a darker Ap horizon or a thicker, darker A1 horizon than Clinton soils. Otley soils have a mollic epipedon but do not have an A2 horizon. Weller soils have more clay in the Bt horizon.

Typical pedon of Clinton silt loam, 2 to 5 percent slopes, 1,800 feet south and 1,600 feet west of the northeast corner of section 18, T. 73 N., R. 14 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 11 inches; brown (10YR 4/3) silt loam; common fine faint mottles of dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4); moderate very thin and thin platy structure parting to weak very fine and fine subangular blocky; friable; common coatings of dark grayish brown (10YR 4/2) on peds; few silt coatings of light gray (10YR 6/1 dry) on peds; slightly acid; gradual smooth boundary.

B1t—11 to 17 inches; brown (10YR 4/3) silty clay loam; moderate very fine and fine subangular blocky structure; friable; common thin discontinuous clay films of brown (10YR 4/3) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; slightly acid; gradual smooth boundary.

B21t—17 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of brown (10YR 4/3) and dark yellowish brown (10YR 4/4); moderate fine and medium subangular blocky and angular blocky structure; firm; thin nearly continuous clay films of brown (10YR 4/3) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B22t—24 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of brown (10YR 4/3) and dark yellowish brown (10YR 4/4); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; thin nearly continuous clay films of brown (10YR 4/3) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23t—34 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of grayish brown (10YR 5/2) and brown (10YR 5/3); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; thin nearly continuous clay films of brown (10YR 4/3) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8), very dark gray (10YR 3/1), and brown (7.5YR 4/4); medium acid; gradual smooth boundary.

B31t—44 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint mottles of grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/6); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; thin nearly continuous clay films of brown (10YR 4/3) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8), very dark gray (10YR 3/1), and brown (7.5YR 4/4); medium acid; gradual smooth boundary.

B32t—60 to 72 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint mottles of grayish brown

(10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/6); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; common thin discontinuous clay films of brown (10YR 4/3) and dark yellowish brown (10YR 4/4) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

C—72 to 86 inches; yellowish brown (10YR 5/4) silt loam; many fine faint mottles of grayish brown (10YR 5/2) and brown (10YR 5/3); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 42 to 72 inches in thickness. The A1 horizon, if there is one, is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). It is 0 to 5 inches thick and is medium acid or slightly acid.

The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is 0 to 8 inches thick and ranges from strongly acid to slightly acid, unless limed. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3) and from strongly acid to slightly acid. The B2t horizon is brown (10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). It is silty clay loam or silty clay. The B3t and C horizons range from yellowish brown (10YR 5/4) to olive gray (5Y 5/2). The upper part of the C horizon is silt loam or silty clay loam.

Colo series

The soils of the Colo series are poorly drained and moderately permeable. They are on bottom land. They formed in silty alluvium, commonly under a native vegetation of swamp grasses, sedges, and prairie grasses that tolerate wetness. Slopes range from 0 to 5 percent.

Colo soils are associated on the landscape with Ely and Zook soils. Ely soils have a thinner mollic epipedon and higher chroma below the mollic epipedon than Colo soils. Zook soils have more clay in the control section.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, 1,670 feet north and 1,190 feet west of the southeast corner of section 14, T. 71 N., R. 13 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; few fine faint mottles of very dark gray (10YR 3/1); moderate medium granular structure; friable; neutral; clear smooth boundary.

A12—10 to 15 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure parting to weak medium granular; friable; many coatings of black (10YR 2/1) on peds; neutral; gradual smooth boundary.

A13—15 to 21 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine and fine subangular blocky structure; friable; many coatings of black (10YR 2/1) on peds; neutral; gradual smooth boundary.

A14—21 to 27 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; firm; common coatings of black (10YR 2/1) on peds; neutral; gradual smooth boundary.

A3—27 to 39 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; few fine distinct mottles of strong brown (7.5YR 5/6) in the lower part; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; neutral; gradual smooth boundary.

C1g—39 to 44 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common coatings of very dark gray (10YR 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C2g—44 to 54 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); weak medium prismatic structure parting to moderate medium subangular blocky; friable; common coatings of very dark gray (10YR 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C3g—54 to 64 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); common fine faint mottles of gray (10YR 5/1); weak medium prismatic structure parting to weak medium subangular blocky; friable; common coatings of dark gray (5Y 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C4g—64 to 72 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); common fine faint mottles of gray (10YR 5/1); massive; friable; common coatings of dark gray (5Y 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 36 to 54 inches thick. The mollic epipedon ranges from 36 to over 60 inches thick.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 36 to 54 inches thick and is slightly acid or neutral. The A1 or Ap horizon is silty clay loam or silt loam.

Coppock series

The soils of the Coppock series are somewhat poorly or poorly drained and moderately permeable. They are on low stream benches, foot slopes, and alluvial fans. The Coppock soils formed in silty alluvium under a native vegetation of trees and tall grasses. Slopes range from 0 to 2 percent.

Coppock soils are associated on the landscape with Koszta, Tuskeego, and Vesser soils. Koszta soils have higher chroma in the B horizon than Coppock soils. Tuskeego soils have more clay in the B horizon. Vesser soils have a mollic epipedon.

Typical pedon of Coppock silt loam, 0 to 2 percent slopes, 2,440 feet north and 1,850 feet east of the southwest corner of section 33, T. 72 N., R. 13 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A21—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; common fine faint mottles of dark gray (10YR 4/1) and dark brown (10YR 3/3); weak very thin platy structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

A22—11 to 16 inches; gray (10YR 5/1) silt loam; common fine faint mottles of dark gray (10YR 4/1), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2); moderate very thin and thin platy structure; friable; many silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and reddish brown (5YR 4/4); medium acid; gradual smooth boundary.

A23—16 to 20 inches; grayish brown (10YR 5/2) silt loam; common fine faint mottles of dark grayish brown (10YR 4/2), brown (10YR 5/3), and yellowish brown (10YR 5/6); moderate thin platy structure parting to weak fine subangular blocky; friable; common coatings of dark grayish brown (10YR 4/2) on peds; many silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and reddish brown (5YR 4/4); strongly acid; gradual smooth boundary.

B21t—20 to 25 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), brown (10YR 5/3), and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2); common silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), very dark gray (10YR 3/1), and yellowish brown (10YR 5/6); strongly acid; gradual smooth boundary.

B22t—25 to 30 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), brown (10YR 5/3), and strong brown (7.5YR 5/6); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5Y 4/4) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23t—30 to 36 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), brown (10YR 5/3), and strong brown (7.5YR 5/6); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B31t—36 to 45 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint and distinct mottles of dark grayish brown (10YR 4/2) brown (10YR 5/3), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; friable; common thin discontinuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B32t—45 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light brownish gray (2.5Y 6/2) and grayish brown (10YR 5/2); moderate medium subangular blocky structure; friable; common thin discontinuous clay films of grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6 & 5/8); medium acid.

The solum ranges from 40 to 70 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and ranges from strongly acid to neutral. The A2 horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2) to gray (10YR 5/1) and from strongly acid to slightly acid. The B2t horizon ranges from gray (10YR 5/1) to light brownish gray (2.5Y 6/2) in color and from very strongly acid to medium acid in reaction.

Douds series

The soils of the Douds series are moderately well drained and moderately permeable. They are on high stream benches along most of the major streams and rivers in the county. They formed in loamy, stratified, water-sorted glacial sediments deposited as alluvium during an earlier geological period. These soils developed under a native vegetation of deciduous trees. Slopes range from 9 to 40 percent.

Douds soils are associated on the landscape with Galland soils and are similar to Caleb and Mystic soils. Galland soils have more clay in the Bt horizon than Douds soils. Caleb soils have a darker, thicker A1 horizon or darker Ap horizon. Mystic soils have more clay in the Bt horizon and have a darker, thicker A1 horizon or darker Ap horizon.

Typical pedon of Douds loam, 14 to 18 percent slopes, 1,320 feet north and 2,010 feet east of the southwest corner of section 29, T. 72 N., R. 13 W.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; medium acid; clear smooth boundary.

A21—4 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few fine faint mottles of brown (10YR 4/3); weak medium platy structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common silt coatings of light gray (10YR 7/2 dry) on peds; medium acid; gradual smooth boundary.

A22—7 to 11 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak medium and thick platy structure parting to weak fine and medium subangular blocky; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common silt coatings of light gray (10YR 7/2 dry) on peds; medium acid; gradual smooth boundary.

B1—11 to 16 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; common silt coatings of light gray (10YR 7/2 dry) on peds; medium acid; gradual smooth boundary.

B21t—16 to 22 inches; brown (7.5YR 4/4) loam; moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of brown (7.5YR 4/4); common silt coatings of light gray (10YR 7/2 dry) on peds; strongly acid; gradual smooth boundary.

B22t—22 to 28 inches; strong brown (7.5YR 5/6) loam; common fine faint mottles of yellowish red (5YR 4/6 & 5/6); weak medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; thin nearly continuous clay films of brown (7.5YR 4/4) and dark reddish brown (5YR 3/4); few silt coatings of light gray (10YR 7/2 dry) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of dark brown (7.5YR 3/2), black (N 2/0), and reddish brown (5YR 3/3); strongly acid; gradual smooth boundary.

B23t—28 to 34 inches; strong brown (7.5YR 5/6) sandy clay loam; common fine faint mottles of yellowish red (5YR 4/6 & 5/6) and pinkish gray (7.5YR 6/2); weak medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; thin nearly continuous clay films of brown (7.5YR 4/4) and dark reddish brown (5YR 3/4); few silt coatings of light gray (10YR 7/2 dry) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of dark brown (7.5YR 3/2), black (N 2/0), and dark reddish brown (5YR 3/3); medium acid; gradual smooth boundary.

B31t—34 to 41 inches; strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) loam; common fine distinct mottles of grayish brown (10YR 5/2), yellowish brown (10YR 5/4), and brown (7.5YR 4/4); moderate medium and coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; thin nearly continuous clay films of brown (7.5YR 4/4) and grayish brown (7.5YR 5/2); common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), dark reddish brown (5YR 3/3), and yellowish red (5YR 4/6); medium acid; clear wavy boundary.

B32t—41 to 52 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) loam; common fine faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/6); weak medium and coarse prismatic structure parting to weak medium angular and subangular blocky; common thin discontinuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

C—52 to 60 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) loam; common fine faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); medium acid.

The solum ranges from 42 to 72 inches in thickness.

The A1 horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). It is loam or silt loam, 0 to 5 inches thick, and strongly acid or medium acid, unless limed. The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is loam, silt loam, or clay loam, 0 to 8 inches thick, and is strongly acid or medium acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is loam or silt loam and ranges from very strongly acid to medium acid.

The B2 horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) and from very strongly acid to medium acid. The B2t horizon is loam, clay loam, or sandy clay loam. The C horizon, if there is one, is at a depth of less than 60 inches and ranges from loamy sand to clay loam.

Edina series

The soils of the Edina series are poorly drained and very slowly permeable. These soils are on narrow to broad upland divides. The Edina soils formed in leached loess under a native vegetation of prairie grasses. Slopes range from 0 to 1 percent.

Edina soils are associated on the landscape with Haig soils and are similar to Belinda and Sperry soils. Haig soils do not have an A2 horizon and contain less clay in the B2t horizon than Edina soils. Belinda soils have a thinner dark-colored epipedon. Sperry soils contain less clay in the B2t horizon.

Typical pedon of Edina silt loam, 0 to 1 percent slopes, 1,180 feet north and 1,380 feet west of the southeast corner of section 29, T. 71 N., R. 15 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A12—10 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A21—14 to 18 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; few fine distinct mottles of brown (7.5YR 4/4); moderate thin platy structure; friable; common coatings of very dark gray (10YR 3/1) on peds; common silt coatings of gray (10YR 6/1) on peds; few very fine segregations (iron oxides) of brown (7.5YR 4/4); slightly acid; clear smooth boundary.

A22—18 to 23 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; few fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate thin platy structure; friable; many silt coats of gray (10YR 6/1) on peds; few fine segregations (iron oxides) of brown (7.5YR 4/4); medium acid; abrupt smooth boundary.

B21t—23 to 32 inches; dark gray (10YR 4/1) silty clay, gray (10YR 6/1) dry; many fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak fine subangular blocky structure; very firm; many coatings of black (10YR 2/1) on peds; common thin clay films of dark gray (10YR 4/1) on peds; many fine segregations (iron oxides) of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); medium acid; gradual smooth boundary.

B22t—32 to 38 inches; gray (10YR 5/1) silty clay; common fine faint and distinct mottles of dark gray (10YR 4/1), very dark gray (10YR 3/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); weak medium subangular blocky structure; very firm; common thin clay films of dark gray (10YR 4/1) on peds; many fine segregations (iron oxides) of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); medium acid; gradual smooth boundary.

B3t—38 to 52 inches; grayish brown (2.5Y 5/2) silty clay; common fine faint and distinct mottles of gray (10YR 5/1), dark gray (10YR 4/1), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and reddish brown (5YR 4/4); weak medium subangular blocky structure; very firm; common thin clay films of grayish brown (10YR 5/2) on peds; many fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), reddish brown (5YR 4/4), and black (10YR 2/1); neutral; gradual smooth boundary.

C—52 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint and distinct mottles of light brownish gray (2.5Y 6/2), strong brown (7.5YR 5/6), and red (2.5YR 4/6); very weak medium subangular blocky structure; firm; common thin clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), red (2.5YR 4/6), and black (10YR 2/1); neutral.

The solum ranges from 44 to 60 inches in thickness.

The Ap or A1 horizon or both range from black (10YR 2/1) to very dark grayish brown (10YR 3/2), and are 10 to 14 inches thick and slightly acid or neutral. The A2 horizon ranges from strongly acid to slightly acid. The B2t horizon ranges from very dark gray (10YR 3/1) to grayish brown (2.5Y 5/2).

Ely series

The soils of the Ely series are somewhat poorly drained and moderately permeable. They are on slightly concave low foot slopes. They formed in silty local alluvium and colluvium under a native vegetation of tall prairie grasses. Slopes range from 2 to 5 percent.

Ely soils are associated on the landscape with Colo, Otley, and Nira soils and are similar to Mahaska soils. Colo soils have a thicker mollic epipedon and have lower chroma below the mollic epipedon than Ely soils. Otley soils have a thinner mollic epipedon and have higher chroma in the B21t horizon. Nira soils have a thinner mollic epipedon and higher chroma in the B1t and B21t horizon. Mahaska soils have a thinner mollic epipedon and more clay in the Bt horizon.

Typical pedon of Ely silty clay loam from an area of Colo-Ely silty clay loams, 2 to 5 percent slopes, 1,250 feet north and 2,110 feet west of the southeast corner of section 26, T. 73 N., R. 14 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 18 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

A3—18 to 28 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct mottles of yellowish brown (10YR 5/6); moderate very fine subangular blocky structure; friable; few fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B1—28 to 34 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine faint mottles of dark grayish brown (10YR 4/2) and common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine subangular blocky structure; friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B2—34 to 40 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B3—40 to 50 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium subangular blocky structure; friable; few discontinuous coatings of very dark grayish brown (10YR 3/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

C—50 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); massive; friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) to brown (7.5YR 4/4) and very dark gray (10YR 3/1); medium acid.

The solum is generally more than 48 inches thick and ranges from 40 to 66 inches. The mollic epipedon ranges from 24 to 36 inches in thickness.

The A horizon is medium acid or slightly acid, unless limed. The Ap or A1 horizon is silty clay loam or silt loam. The B1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is medium acid or slightly acid. The B2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and is medium acid or slightly acid.

Galland series

The soils of the Galland series are moderately well or somewhat poorly drained and slowly permeable. They are on high stream benches. They formed in moderately fine and fine textured, stratified water-sorted glacial sediments deposited as alluvium during an early geological period. These soils developed under a native vegetation of deciduous trees. Slopes range from 5 to 18 percent.

Galland soils are associated on the landscape with Douds and Lindley soils and are similar to Mystic soils. Douds soils have less clay and more sand in the B horizon than Galland soils. Lindley soils have less clay in the B horizon, formed in glacial till, and do not have stratification throughout their profiles. Mystic soils have a thicker, darker colored A1 horizon or darker colored Ap horizon.

Typical pedon of Galland loam, 9 to 14 percent slopes, moderately eroded, 340 feet north and 2,370 feet east of the southwest corner of section 29, T. 71 N., R. 13 W.

Ap—0 to 6 inches; brown (7.5YR 4/2) loam, brown (10YR 5/3) dry; some brown (7.5YR 4/4) clay loam is mixed into the plow layer; moderate fine and medium granular structure; friable; few small pebbles; slightly acid; abrupt smooth boundary.

B1t—6 to 11 inches; brown (7.5YR 4/4) clay loam; common fine faint mottles of reddish brown (5Y 4/3

& 4/4) and yellowish red (5YR 4/6); weak fine and medium subangular blocky structure; friable; few thin patchy clay films of reddish brown (5YR 4/3) and dark reddish brown (5YR 3/4) on peds; common fine segregations (iron and manganese oxides) of red (2.5YR 4/6 & 4/8) and very dark gray (10YR 3/1); few small pebbles; slightly acid; gradual smooth boundary.

B21t—11 to 17 inches; brown (7.5YR 5/4) and yellowish red (5YR 4/6) clay loam; common fine faint mottles of reddish brown (5YR 4/4 & 5/4) and red (2.5YR 4/6 & 4/8); moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common thin discontinuous clay films of reddish brown (5YR 4/4) on peds; common fine segregations (iron and manganese oxides) of red (2.5YR 4/6 & 4/8) and very dark gray (10YR 3/1); few small pebbles; medium acid; gradual smooth boundary.

B22t—17 to 22 inches; brown (7.5YR 4/4) clay loam; common fine faint mottles of brown (7.5YR 5/4) and yellowish red (5YR 4/6 & 4/8); moderate medium and coarse prismatic structrure parting to moderate fine and medium subangular blocky; firm; common thin discontinuous clay films of reddish brown (5YR 4/4); common fine segregations (iron and manganese oxides) of red (2.5YR 4/6 & 4/8) and very dark gray (10YR 3/1); few small pebbles; medium acid; gradual smooth boundary.

B23t—22 to 29 inches; brown (7.5YR 5/4) clay loam; common fine faint mottles of reddish brown (5YR 4/4 & 5/4) and yellowish red (5YR 4/6); moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; firm; common thin discontinuous clay films of dark brown (7.5YR 4/2) and brown (7.5YR 5/2); common fine and medium segregations and concretions (iron and manganese oxides) of red (2.5YR 4/6 & 4/8) and very dark gray (10YR 3/1); few small pebbles; medium acid; gradual smooth boundary.

B31t—29 to 38 inches; strong brown (7.5YR 5/6) clay loam; common fine faint mottles of reddish brown (5YR 4/4 & 5/4) and yellowish red (5YR 4/6); weak fine and medium subangular blocky structure; friable; thin nearly continuous clay films of dark brown (7.5YR 4/2) and brown (7.5YR 5/2); common fine and medium segregations and concretions (iron and manganese oxides) of red (2.5YR 4/6 & 4/8) and very dark gray (10YR 3/1); few small pebbles; strongly acid; gradual smooth boundary.

B32t—38 to 50 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) sandy loam; common fine faint mottles of yellowish brown (10YR 5/4); weak fine and medium subangular blocky structure; friable; thin nearly continuous clay films of brown (7.5YR 4/2 & 4/4); common fine and medium segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), yellowish red (5YR 4/6), and very dark gray (10YR 3/1); few small pebbles; strongly acid; abrupt smooth boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4 & 5/6) sandy loam; common fine faint mottles of grayish brown (10YR 5/2), brown (10YR 5/3), and dark yellowish brown (10YR 4/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); few small pebbles; medium acid.

The solum ranges from 48 to 72 inches in thickness.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (7.5YR 5/2). It is loam or silt loam and is strongly acid or medium acid, unless limed. In some areas thin A1 and A2 horizons are present. The B2t horizon ranges from dark grayish brown (10YR 4/2) to yellowish red (5YR 4/6). It is clay loam, clay, or silty clay and ranges from very strongly acid to medium acid. The B3t and C horizons range from strong brown (7.5YR 5/6) to grayish brown (10YR 5/2).

Gara series

The soils of the Gara series are moderately well drained or well drained and moderately slowly permeable. These soils are on convex, narrow, moderately steep or steep ridgetops, nose slopes, and valley side slopes in the uplands. The Gara soils formed in glacial till under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 9 to 25 percent.

Gara soils are associated on the landscape with Armstrong and Pershing soils and are similar to Lindley soils. Armstrong soils have more clay in the B horizon than Gara soils. Pershing soils contain more silt and less sand in the solum. Lindley soils have a lighter color Ap horizon or a thinner dark-colored A1 horizon.

Typical pedon of Gara loam, 18 to 25 percent slopes, 350 feet north and 290 feet east of the southwest corner of section 34, T. 71 N., R. 15 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; common fine faint mottles of brown (10YR 4/3); weak fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common small pebbles; medium acid; gradual smooth boundary.

B1t—11 to 17 inches; yellowish brown (10YR 5/4) clay loam; moderate fine and medium angular blocky and subangular blocky structure; firm; few coatings of very dark grayish brown (10YR 3/2) on peds;

common thin discontinuous clay films of brown (10YR 4/3) on peds; common small pebbles; medium acid; gradual smooth boundary.

B2t—17 to 27 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct mottles of strong brown (7.5YR 5/8); strong fine and medium angular blocky and subangular blocky structure; firm; thin continuous clay films of dark brown (10YR 4/3 to 7.5YR 3/2) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); common small pebbles; strongly acid; gradual smooth boundary.

B3t—27 to 40 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium distinct mottles of strong brown (7.5YR 5/8); few fine distinct mottles of grayish brown (10YR 5/2); moderate coarse prismatic structure parting to strong medium angular blocky and subangular blocky; firm; common thin discontinuous clay films of dark brown (10YR 4/3 to 7.5YR 3/2) on peds; common fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); common small pebbles; medium acid; gradual smooth boundary.

C1—40 to 51 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium distinct mottles of strong brown (7.5YR 5/6 & 5/8), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2); weak coarse prismatic structure parting to weak medium subangular blocky; firm; common fine and medium segregations and concretions of calcium carbonate; common small and medium pebbles; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—51 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium distinct mottles of strong brown (7.5YR 5/6 & 5/8), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2); massive; firm; common fine and medium segregations and concretions of calcium carbonate; common small and medium pebbles; strong effervescence; moderately alkaline.

The solum ranges from 36 to 70 inches in thickness. The depth to carbonates also ranges from 36 to 70 inches.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is loam or clay loam, 7 to 9 inches thick, and strongly acid or medium acid, unless limed. The A2 horizon, if there is one, is strongly acid or medium acid. The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). The B2t horizon is strongly acid or medium acid. The C horizon is dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4 or 5/6) with mottles ranging from light gray (10YR 7/1) to strong brown (7.5YR 5/8). It ranges from slightly acid to moderately alkaline.

Givin series

The soils of the Givin series are somewhat poorly drained and moderately slowly permeable. These soils are on narrow to moderately wide, convex ridgetops and on upper side slopes in the loess-covered uplands, and on high, loess-covered stream terraces. They formed in leached loess under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 2 to 5 percent.

Givin soils are associated on the landscape with Ladoga soils and are similar to Mahaska and Otley soils. Ladoga soils have higher chroma in the B2t horizon than Givin soils. Mahaska soils have a mollic epipedon and do not have an A2 horizon. Otley soils have a mollic epipedon, do not have an A2 horizon, and have higher chroma in the B2t horizon.

Typical pedon of Givin silt loam, 2 to 5 percent slopes, 990 feet north and 2,310 feet east of the southwest corner of section 22, T. 73 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium and coarse platy structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; slightly acid; gradual smooth boundary.

B1t—11 to 14 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silty clay loam; moderate very fine and fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; medium acid; gradual smooth boundary.

B21t—14 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint mottles of brown (10YR 4/3) and very dark grayish brown (10YR 3/2); weak medium prismatic structure parting to moderate fine subangular blocky and angular blocky; firm; thin nearly continuous clay films of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; medium acid; gradual smooth boundary.

B22t—20 to 27 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium prismatic structure parting to moderate fine subangular blocky and angular blocky; firm; thin nearly continuous clay films of very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) on peds; few silt coatings of light gray (10YR 7/1 dry) on peds; few fine segregations (iron and manganese oxides) of strong brown (7.5YR 5/6), dark brown (7.5YR 3/2), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B23t—27 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light olive brown (2.5Y 5/4) and dark grayish brown (2.5Y 4/2) and common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium prismatic structure parting to moderate fine and medium subangular blocky and angular blocky; firm; thin nearly continuous clay films of dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark brown (7.5YR 3/2), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B31t—32 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) and common distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium prismatic structure parting to moderate medium subangular blocky; friable; common thin discontinuous clay films of dark grayish brown (2.5Y 4/2), grayish brown (2.5Y 5/2), and very dark grayish brown (2.5Y 3/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark brown (7.5YR 3/2), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B32t—44 to 52 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and common fine distinct mottles of light olive brown (2.5Y 5/4); weak medium prismatic structure parting to weak medium subangular blocky; friable; common thin discontinuous clay films of grayish brown (2.5Y 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

C—52 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of reddish brown (5YR 4/4), yellowish red (5YR 4/6 & 4/8), and very dark gray (10YR 3/1); slightly acid.

The solum thickness is more than 48 inches and ranges from 40 to 72 inches.

The Ap or A1 horizon is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2). It ranges from strongly acid to slightly acid, unless limed. The B2t horizon is medium acid or strongly acid. The C horizon is silty clay loam or silt loam.

Gosport series

The soils of the Gosport series are moderately deep, moderately well drained, and very slowly permeable. These soils are on convex side slopes in the uplands. The Gosport soils formed in residuum weathered from brown and gray acid shales under a native vegetation of deciduous trees. Slopes range from 9 to 40 percent.

Gosport soils are associated on the landscape with Galland, Keswick, and Lindley soils. Galland, Keswick, and Lindley soils contain less clay and more sand in the B and C horizons than Gosport soils. Galland soils formed in fine-textured older alluvium, and Keswick and Lindley soils formed in glacial till.

Typical pedon of Gosport silt loam, 18 to 40 percent slopes, 810 feet north and 400 feet west of the southeast corner of the northeast quarter of section 21, T. 72 N., R. 15 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine granular structure; friable; few 2- to 5-millimeter flat clay-ironstone fragments; neutral; clear smooth boundary.

A2—4 to 7 inches; grayish brown (10YR 5/2) silty clay loam, light gray (10YR 7/1) dry; common fine faint mottles of brown (10YR 5/3) and light brownish gray (10YR 6/2); moderate thin platy structure; friable; few clay-ironstone fragments smaller than in the A1 horizon; strongly acid; clear smooth boundary.

B1—7 to 11 inches; brown (10YR 5/3) silty clay; weak fine subangular blocky structure; firm; few discontinuous grainy silt coatings of grayish brown (2.5Y 5/2); few 5- to 10-millimeter thick clay-ironstone fragments; common hard shale fragments 2 to 5 millimeters thick; very strongly acid; gradual smooth boundary.

B2—11 to 19 inches; light olive brown (2.5Y 5/3) silty clay; moderate medium angular blocky structure; extremely firm; common hard shale fragments 2 to 5 millimeters thick; few 2- to 5-millimeter clay-ironstone fragments; very strongly acid; gradual smooth boundary.

B3—19 to 27 inches; grayish (2.5Y 5/2) clay; many fine distinct mottles of yellowish brown (10YR 5/6) in interiors of peds; few fine distinct mottles of yellowish brown (10YR 5/6); weak medium angular blocky structure; extremely firm; common thin clay films of brown (7.5YR 4/4) on vertical faces; few clay-ironstone and hard shale fragments; extremely acid; gradual smooth boundary.

Cr1—27 to 60 inches; gray (N 5/0) clay shale; common fine and medium distinct mottles of light olive brown

(2.5Y 5/4) and yellowish brown (10YR 5/6); weak medium platy structure; extremely firm; common fine distinct horizontal bands of very dark gray (N 3/0) clay at a depth of 41 to 55 inches; few small clay-ironstone and shale fragments; extremely acid; gradual smooth boundary.

Cr2—60 to 72 inches; black (N 2/0) clay shale; moderate medium platy structure; extremely firm; common bands (iron oxides) of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); extremely acid.

The solum ranges from 20 to 40 inches in thickness. Depth to weathered shale bedrock is 20 to 40 inches.

The A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). It is silt loam or silty clay loam. The A1 horizon is 0 to 5 inches thick and is medium acid or slightly acid, unless limed. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3) and from very strongly acid to slightly acid. The B1 horizon ranges from brown (10YR 5/3) to light yellowish brown (2.5Y 6/4). It is silty clay or clay and ranges from extremely acid to strongly acid. The B2 horizon is silty clay or clay.

Grundy series

The soils of the Grundy series are somewhat poorly drained and slowly permeable. These soils are on convex ridgetops and upper side slopes in the loess-covered uplands. The Grundy soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 2 to 5 percent.

Grundy soils are associated on the landscape with Arispe and Haig soils and are similar to Pershing and Weller soils. Arispe soils have less clay in the B2t horizon than Grundy soils and have more clay in the Ap horizon. Haig soils have lower chroma in the B2t horizon. Pershing and Weller soils do not have a mollic epipedon but have an A2 horizon.

Typical pedon of Grundy silt loam, 2 to 5 percent slopes, 2,285 feet north and 1,860 feet east of the southwest corner of section 30, T. 71 N., R. 15 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.

A12—10 to 13 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine and fine subangular blocky structure parting to moderate fine and medium granular; friable; medium acid; gradual smooth boundary.

A3—13 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, gray (10YR 5/1) dry; few fine distinct mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); moderate very fine and fine subangular blocky structure; friable; common coatings of very dark gray (10YR 3/1) on peds; strongly acid; clear smooth boundary.

B1—16 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct mottles of olive brown (2.5Y 4/4), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); moderate very fine and fine subangular blocky structure; firm; common coatings of dark gray (10YR 4/1) and very dark gray (10YR 3/1) on peds; common very thin clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds; few fine segregations (iron oxides) of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); strongly acid; gradual smooth boundary.

B21t—19 to 23 inches; dark grayish brown (10YR 4/2) silty clay; many fine and medium distinct mottles of olive brown (2.5Y 4/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; very firm; common coatings of dark gray (10YR 4/1) and very dark gray (10YR 3/1) on peds; common thin clay films of dark gray (10YR 4/1) and very dark gray (10YR 3/1) on peds; common fine segregations (iron oxides) of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); medium acid; gradual smooth boundary.

B22t—23 to 28 inches; dark grayish brown (2.5Y 4/2) silty clay; many fine and medium distinct mottles of yellowish brown (10YR 5/6), grayish brown (2.5Y 5/2), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; very firm; common coatings of dark gray (10YR 4/1) and very dark gray (10YR 3/1) on peds; common thin clay films of dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and black (10YR 2/1); slightly acid; gradual smooth boundary.

B23t—28 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine and medium distinct mottles of olive brown (2.5Y 4/4), yellowish brown (10YR 5/6), and yellowish red (5YR 4/6); moderate medium subangular blocky structure; common coatings of dark grayish brown (2.5Y 4/2), dark gray (10YR 4/1), and very dark gray (10YR 3/1) on peds; common thin clay films of dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

B31t—42 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine and medium distinct mottles of olive brown (2.5Y 4/4), yellowish brown (10YR 5/6), and light olive gray (5Y 6/2); weak medium subangular blocky structure; firm; common thin clay films of dark gray (5Y 4/1) and very dark grayish brown (2.5Y 3/2) on peds and root channels; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

B32t—52 to 62 inches; olive gray (5Y 5/2) silty clay loam; common fine and medium distinct mottles of yellowish brown (10YR 5/6), olive brown (2.5Y 4/4), brown (7.5YR 4/4), and dark reddish brown (5YR 3/4); very weak medium subangular blocky structure; firm; few thin clay films of grayish brown (2.5Y 5/2), very dark grayish brown (2.5Y 3/2), and very dark gray (10YR 3/1) on peds and in root channels; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C—62 to 86 inches; light olive gray (5Y 6/2) silty clay loam; common fine and medium distinct mottles of yellowish brown (10YR 5/6), olive gray (5Y 5/2), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and black (10YR 2/1); neutral.

The solum ranges from 40 to 72 inches in thickness.

The Ap and A1 horizons are black (10YR 2/1), very dark brown (10YR 2/2), and very dark gray (10YR 3/1). They are silt loam or silty clay loam and 8 to 17 inches thick. The A3 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It ranges from strongly acid to slightly acid. The B1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (2.5Y 4/2) and strongly acid to slightly acid. The B2t horizon ranges from strongly acid to slightly acid.

Haig series

The soils of the Haig series are poorly drained and have slow permeability. These soils are on broad flats on loess-covered upland divides. The Haig soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 0 to 2 percent.

Haig soils are associated on the landscape with Grundy soils and are similar to Belinda, Edina, Sperry, and Taintor soils. Grundy soils have higher chroma in the B2t horizon than Haig soils. Belinda soils do not have a mollic epipedon and have an A2 horizon. Edina soils have more clay in the B3t horizon and have an A2 horizon. Sperry soils have an A2 horizon. Taintor soils have less clay in the B2t horizon.

Typical pedon of Haig silt loam, 0 to 2 percent slopes, 1,500 feet south and 25 feet east of the northwest corner of section 11, T. 71 N., R. 12 W.

Ap—0 to 11 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A12—11 to 17 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine and fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B1t—17 to 22 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common fine faint mottles of very dark grayish brown (10YR 3/2); moderate very fine and fine subangular blocky structure; firm; common discontinuous coatings of black (10YR 2/1) on peds; common thin nearly continuous clay films of very dark gray (10YR 3/1) on peds; medium acid; gradual smooth boundary.

B21gt—22 to 26 inches; dark gray (10YR 4/1) silty clay; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6); moderate very fine and fine subangular blocky structure; very firm; common thin nearly continuous clay films of very dark gray (10YR 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B22gt—26 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine faint and distinct mottles of grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6); moderate very fine and fine subangular blocky structure; very firm; common thin nearly continuous clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B23gt—36 to 44 inches; olive gray (5Y 5/2) silty clay loam; common fine faint and distinct mottles of olive gray (5Y 4/2), yellowish brown (10YR 5/6), and light brownish gray (2.5Y 6/2); weak fine and medium subangular blocky structure; firm; common thin discontinuous clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B3gt—44 to 55 inches; olive gray (5Y 5/2) silty clay loam; common fine faint and distinct mottles of light olive gray (5Y 6/2) and yellowish brown (10YR 5/6); weak medium subangular blocky structure; firm; common thin patchy clay films of very dark gray (10YR 3/1) and dark gray (10YR 4/1) on peds and in root channels; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

Cg—55 to 72 inches; olive gray (5Y 5/2) silty clay loam; common fine faint and distinct mottles of light olive gray (5Y 6/2), pale olive (5Y 6/3), and yellowish brown (10YR 5/6); massive; friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness. The mollic epipedon ranges from 16 to 24 inches thick.

The Ap and A1 horizons are black (10YR 2/1) or very dark gray (10YR 3/1). They are silt loam or silty clay loam. The Ap and A1 horizons range from 8 to 16 inches thick and are medium acid or slightly acid, unless limed. The A3 horizon, if there is one, is black (10YR 2/1) or very dark gray (10YR 3/1). The B1t horizon ranges from very dark gray (10YR 3/1) to dark gray (5Y 4/1). It is silty clay loam or silty clay and is strongly acid or medium acid. The B2t horizon ranges from very dark gray (10YR 3/1) to light olive gray (5Y 6/2) and is strongly acid or medium acid.

Hedrick series

The soils of the Hedrick series are moderately well drained and moderately permeable. These soils are on short, convex and straight side slopes bordering nearly level, stable, upland divides. The Hedrick soils formed in deoxidized leached loess under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 5 to 9 percent.

Hedrick soils are associated on the landscape with Ladoga soils and are similar to Nira soils. Ladoga soils have more clay in the B2t horizon than Hedrick soils and have higher chroma in the lower part of the B2t horizon and the B3 horizon. Nira soils have a mollic epipedon.

Typical pedon of Hedrick silt loam from an area of Ladoga-Hedrick silt loams, 5 to 9 percent slopes, moderately eroded, 310 feet south and 410 feet east of the northwest corner of section 32, T. 73 N., R. 13 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; some brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam is mixed into the plow layer; moderate fine granular structure; friable; neutral; clear smooth boundary.

B1—7 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/4); weak very fine and fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2); common silt coatings of gray (10YR 6/1 dry) on peds; medium acid; gradual smooth boundary.

B21t—12 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and brown (10YR 5/3); moderate fine subangular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and brown (10YR 4/3) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; few fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B22t—18 to 25 inches; light olive brown (2.5Y 5/4) silty clay loam; common fine faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/4); moderate fine and medium subangular blocky and angular blocky structure; friable; thin nearly continuous clay films of brown (10YR 5/3) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B31t—25 to 34 inches; olive gray (5Y 5/2) silty clay loam; many fine faint and distinct mottles of olive (5Y 5/4), brown (7.5YR 5/4), and strong brown (7.5YR 5/6); moderate fine and medium subangular blocky and angular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B32t—34 to 44 inches; olive gray (5Y 5/2) silty clay loam; many fine faint and distinct mottles of olive (5Y 5/4), brown (7.5YR 5/4), and strong brown (7.5YR 5/6); weak fine and medium subangular blocky structure; friable; common thin discontinuous clay films of grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

C—44 to 60 inches; gray (5Y 5/1) silt loam; common fine faint and distinct mottles of olive gray (5Y 5/2) and brown (7.5YR 5/4); massive; friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); neutral.

The solum ranges from 36 to 60 inches in thickness.

The Ap or A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and ranges from medium acid to neutral. The A2 horizon, if there is one, is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and ranges from strongly acid to slightly acid. The B21t horizon is brown (10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). It ranges from strongly acid to slightly acid. The B3t horizon ranges from gray (10YR 5/1) to light olive gray (5Y 6/2) and from strongly acid to slightly acid. The gray colors in the B3 and C horizons are relict features.

Hoopeston series

The soils of the Hoopeston series are somewhat poorly drained and have moderately rapid permeability in the upper part and rapid permeability in the lower part. They are on low stream terraces. The Hoopeston soils formed in loamy and sandy alluvial sediments under a native vegetation of prairie grasses. Slopes range from 1 to 3 percent.

Hoopeston soils are associated on the landscape with Sparta and Waukee soils. Sparta soils have less clay in the solum and have higher chroma in the B horizon than Hoopeston soils. Waukee soils have more clay and less sand in the solum and have higher chroma in the B horizon.

Typical pedon of Hoopeston fine sandy loam, 1 to 3 percent slopes, 1,390 feet south and 60 feet west of the northeast corner of section 9, T. 72 N., R. 14 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; very friable; neutral; clear smooth boundary.

A3—8 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate very fine and fine granular; very friable; many coatings of very dark brown (10YR 2/2) on peds; slightly acid; gradual smooth boundary.

B21—16 to 22 inches; dark brown (10YR 3/3) fine sandy loam, grayish brown (10YR 5/2) dry; common fine faint mottles of dark grayish brown (10YR 4/2), brown (10YR 4/3), and grayish brown (10YR 5/2); weak fine and medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B22—22 to 30 inches; brown (10YR 4/3) fine sandy loam; pale brown (10YR 6/3) dry; common fine faint mottles of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) and common fine distinct mottles of yellowish brown (10YR 5/6); weak medium subangular blocky structure; very friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B3—30 to 40 inches; brown (10YR 4/3) fine sandy loam; common fine faint mottles of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) and common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium subangular blocky structure; very friable; common fine and medium segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

C1—40 to 50 inches; dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) fine sand; common fine faint mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); single grain; loose; common fine and medium segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

C2—50 to 60 inches; dark grayish brown (10YR 4/2) fine sand; common fine and medium distinct mottles of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and yellowish brown (10YR 5/6); single grain; loose; common fine and medium segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 20 to 44 inches in thickness.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is fine sandy loam, but ranges from sandy loam to loam. The A horizon ranges from strongly acid to neutral. The B horizon ranges from dark brown (10YR 3/3) to yellowish brown (10YR 5/4) and has gray mottles throughout. It is fine sandy loam or sandy loam that has thin strata of loam in places. The B horizon is strongly acid to neutral.

Humeston series

The soils of the Humeston series are poorly drained or very poorly drained and have moderately slow permeability in the upper part and very slow permeability in the lower part. These soils are on bottom land. The Humeston soils formed in silty and clayey alluvium. The native vegetation was swamp grasses, sedges, and prairie grasses that tolerate wetness. Slopes range from 0 to 5 percent.

Humeston soils are associated on the landscape with Colo, Coppock, Tuskeego, Vesser, and Zook soils. Colo soils contain less clay in their control section than Humeston soils, do not have an A2 horizon, and have a thicker mollic epipedon. Coppock soils do not have a mollic epipedon and have less clay in the B horizon. Tuskeego soils do not have a mollic epipedon. Vesser soils have less clay in the B horizon. Zook soils do not have an A2 horizon and have a thicker mollic epipedon.

Typical pedon of Humeston silt loam, 0 to 2 percent slopes, 1,335 feet south and 720 feet west of the northeast corner of section 35, T. 71 N., R. 12 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 14 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak fine and medium subangular blocky structure; parting to fine and medium granular; friable; neutral; clear smooth boundary.

A2—14 to 22 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; moderate thin platy structure; friable; continuous coatings of black (10YR 2/1) and very dark gray (10YR 3/1) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; medium acid; clear smooth boundary.

B21t—22 to 30 inches; very dark gray (10YR 3/1) silty clay; common fine distinct mottles of dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and brown (7.5YR 4/4); moderate very fine and fine subangular blocky structure; very firm; common discontinuous coatings of black (10YR 2/1) on peds; common fine and very fine segregations (iron oxides) of dark yellowish brown (10YR 4/4) and brown (7.5YR 4/4); strongly acid; gradual smooth boundary.

B22t—30 to 36 inches; dark gray (10YR 4/1) silty clay; common fine distinct mottles of brown (10YR 4/3) and dark yellowish brown (10YR 4/4); weak fine and medium subangular blocky structure; very firm; common discontinuous coatings of very dark gray (10YR 3/1) on peds; common segregations (iron oxides) of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); strongly acid; gradual smooth boundary.

B31t—36 to 44 inches; dark gray (10YR 4/1) silty clay; common fine distinct mottles of brown (10YR 4/3), grayish brown (10YR 5/2), and olive brown (2.5Y 4/4); weak medium subangular blocky structure; very firm; common discontinuous coatings of very dark gray (10YR 3/1) on peds; common very fine segregations (iron oxides) of strong brown (7.5YR 5/6) and brown (7.5YR 4/4); slightly acid; gradual smooth boundary.

B32t—44 to 49 inches; grayish brown (2.5Y 5/2) silty clay; common fine and medium distinct mottles of brown (10YR 4/3), dark gray (10YR 4/1), olive brown (2.5 4/4), brown (7.5YR 4/4), and strong brown (7.5YR 5/6); weak medium subangular blocky structure; very firm; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), yellowish red (5YR 4/6), and black (10YR 2/1); slightly acid; gradual smooth boundary.

C—49 to 60 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam; common fine and medium distinct mottles of yellowish brown (10YR 5/6), dark gray (10YR 4/1), strong brown (7.5YR 5/6), brown (7.5YR 4/4), and yellowish red (5YR 4/6); massive; firm; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (2.5YR 3/4), and black (10YR 2/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness.

The Ap and A1 horizons are black (10YR 2/1) or very dark gray (10YR 3/1). They are 10 to 16 inches thick and are strongly acid or medium acid, unless limed. The A2 horizon is dark gray (10YR 4/1) or gray (10YR 5/1). It ranges from very strongly acid to medium acid. The B2t horizon ranges from black (N 2/0) to dark gray (10YR 4/1). It is silty clay or silty clay loam and ranges from very strongly acid to slightly acid.

Kalona series

The soils of the Kalona series are poorly drained and have moderately slow permeability. These soils are in the center of broad flats on the loess-covered upland divides. The Kalona soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 0 to 1 percent.

Kalona soils are associated on the landscape with Sperry and Taintor soils and are similar to Haig soils. Sperry, Taintor, and Haig soils have an argillic B horizon. Sperry and Haig soils have more clay in the B horizon than Kalona soils. Sperry soils have an A2 horizon. Taintor soils have less clay in the Ap horizon.

Typical pedon of Kalona silty clay loam, 0 to 1 percent slopes, 200 feet north and 1,340 feet east of the southwest corner of section 5, T. 73 N., R. 12 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; firm; neutral; clear smooth boundary.

A12—8 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; firm; neutral; gradual smooth boundary.

B21—15 to 20 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; few fine distinct mottles of yellowish brown (10YR 5/4 & 5/6); moderate fine and medium subangular blocky structure; firm; few coatings of black (10YR 2/1) on peds; few fine segregations (iron oxides) of strong brown (7.5YR 5/6) and yellowish red (5YR 5/6 & 5/8); neutral; gradual smooth boundary.

B22—20 to 25 inches; dark gray (5Y 4/1) silty clay; common fine faint mottles of olive gray (5Y 4/2) and dark grayish brown (2.5Y 4/2); moderate fine and medium subangular blocky structure; firm; common coatings of very dark gray (10YR 3/1) on peds; few fine segregations (iron oxides) of strong brown (7.5YR 5/6) and yellowish red (5YR 5/6 & 5/8); neutral; gradual smooth boundary.

B23—25 to 30 inches; olive gray (5Y 5/2) silty clay loam; common fine faint mottles of gray (5Y 5/1), olive (5Y 5/3 & 4/2), and light olive brown (2.5Y 5/4 & 5/6); moderate fine and medium subangular blocky structure; firm; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

B31—30 to 36 inches; olive gray (5Y 5/2) silty clay loam; common fine faint mottles of olive (5Y 5/3), grayish brown (2.5Y 5/2), and light olive brown (2.5Y 5/4); moderate fine and medium subangular blocky structure; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), yellowish red (5YR 4/6 & 4/8), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

B32—36 to 45 inches; olive gray (5Y 5/2) silty clay loam; common fine faint mottles of olive (5Y 5/3), grayish brown (2.5Y 5/2), and light olive brown (2.5Y 5/4); weak fine and medium subangular blocky structure; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), yellowish red (5YR 4/6 & 4/8), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C—45 to 60 inches; olive gray (5Y 5/2) silt loam; common fine faint mottles of olive (5Y 5/3), grayish brown (2.5Y 5/2), and light olive brown (2.5Y 5/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); common fine and medium segregations and concretions of calcium carbonate; slight effervescence; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. The mollic epipedon ranges from 14 to 24 inches thick.

The Ap and A1 horizons are black (10YR 2/1 or N 2/0) and are 10 to 16 inches thick. The B2 horizon ranges from very dark gray (10YR 3/1) to olive gray (5Y 5/2) and is silty clay loam or silty clay. The C horizon is silty clay loam or silt loam and ranges from neutral to mildly alkaline.

Keswick series

The soils of the Keswick series are moderately well drained and slowly permeable. These soils are on short, convex side slopes and convex nose slopes in the uplands. The Keswick soils formed in a Paleosol weathered from glacial till under a native vegetation of deciduous trees. Slopes range from 9 to 18 percent.

Keswick soils are associated on the landscape with Clinton, Lindley, and Weller soils and are similar to Adair and Armstrong soils. Clinton soils contain more silt and less clay and sand than Keswick soils. Lindley soils have less clay in the B2t horizon. Weller soils have more silt and less sand. Adair soils have a mollic epipedon and do not have an A2 horizon. Armstrong soils have a thicker dark-colored A1 horizon or a darker colored Ap horizon.

Typical pedon of Keswick loam, 9 to 14 percent slopes, 1,910 feet north and 2,070 feet east of the southwest corner of section 20, T. 71 N., R. 13 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; common fine faint mottles of very dark gray (10YR 3/1); weak very fine and fine granular structure; friable; medium acid; gradual smooth boundary.

A21—4 to 8 inches; brown (10YR 5/3) loam; common fine faint mottles of grayish brown (10YR 5/2); moderate fine and medium platy structure; friable; medium acid; gradual smooth boundary.

A22—8 to 11 inches; brown (10YR 5/3) clay loam; common fine faint mottles of yellowish brown (10YR 5/4); moderate medium and coarse platy structure parting to weak fine subangular blocky; friable; common small pebbles; strongly acid; gradual smooth boundary.

B1t—11 to 17 inches; yellowish brown (10YR 5/4) clay loam; common fine faint mottles of brown (10YR 5/3); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of brown (10YR 5/3) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; common small pebbles; strongly acid; gradual smooth boundary.

IIB21t—17 to 25 inches; strong brown (7.5YR 5/6) clay; common fine faint and distinct mottles of brown (7.5YR 5/4), strong brown (7.5YR 5/8), reddish brown (5YR 5/4), and yellowish red (5YR 5/6 & 5/8); moderate medium subangular blocky structure; very firm; thin nearly continuous clay films of brown (10YR 4/3) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish red (5YR 4/6 & 4/8) and red (2.5YR 4/6 & 4/8); common small pebbles; strongly acid; gradual smooth boundary.

IIB22t—25 to 37 inches; strong brown (7.5YR 5/6) clay; common fine faint and distinct mottles of yellowish red (5YR 5/6 & 5/8), brown (7.5YR 4/4), and strong brown (7.5YR 5/8); moderate medium subangular blocky structure; very firm; thin nearly continuous clay films of brown (7.5YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish red (5YR 4/6 & 4/8) and red (2.5YR 4/6 & 4/8); common small pebbles; strongly acid; gradual smooth boundary.

IIB31t—37 to 50 inches; yellowish brown (10YR 5/4) clay loam; common fine faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); moderate medium subangular blocky structure; firm; thin nearly continuous clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); common small pebbles; medium acid; gradual smooth boundary.

IIB32t—50 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine faint mottles of brown

(10YR 5/3) and yellowish brown (10YR 5/6); weak medium subangular blocky structure; firm; common thin discontinuous clay films of brown (10YR 5/3) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); common small pebbles; slightly acid.

The solum ranges from 42 to 72 inches in thickness.

The A1 horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). It is loam or silt loam. The A1 horizon is 0 to 5 inches thick and is strongly acid or medium acid, unless limed. The Ap horizon, if there is one, is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is loam, silt loam, or silty clay loam. The Ap horizon is 0 to 8 inches thick and is strongly acid or medium acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It is loam, clay loam, or silt loam. The B2t horizon ranges from reddish brown (5YR 4/3) to strong brown (7.5YR 5/6). It is clay loam or clay and is strongly acid or medium acid.

Koszta series

The soils of the Koszta series are somewhat poorly drained and moderately permeable. They are on low stream terraces. They formed in silty alluvium under a native vegetation of trees and prairie grasses. Slopes range from 0 to 2 percent.

Koszta soils are associated on the landscape with the Tuskeego soils and are similar to Nevin soils. Tuskeego soils have more clay in the B2t horizon and have lower chroma in the B horizon than Koszta soils. Nevin soils have a mollic epipedon and do not have an A2 horizon.

Typical pedon of Koszta silt loam, 0 to 2 percent slopes, 2,240 feet south and 1,030 feet west of the northeast corner of section 35, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A2—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure parting to moderate fine subangular blocky; friable; few coatings of very dark grayish brown (10YR 3/2) on peds; common silt coatings of light gray (10YR 7/2 dry) on peds; slightly acid; gradual smooth boundary.

B1t—14 to 23 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silty clay loam; moderate very fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; few thin patchy clay films of very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) on peds; common silt coatings of light gray (10YR 7/1 dry) on peds; slightly acid; gradual smooth boundary.

B21t—23 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B22t—29 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of dark grayish brown (2.5Y 4/2) and light brownish gray (2.5Y 6/2) and common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B31t—36 to 44 inches; light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6), brown (7.5YR 4/4), light olive brown (2.5Y 5/4), grayish brown (2.5Y 5/2), and dark grayish brown (2.5Y 4/2); moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common thin discontinuous clay films of dark grayish brown (2.5Y 4/2), grayish brown (2.5Y 5/2), and very dark grayish brown (2.5Y 3/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

B32t—44 to 52 inches; light olive gray (5Y 6/2) silty clay loam; common fine faint mottles of gray (5Y 6/1) and olive gray (5Y 5/2) and common fine distinct mottles of light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6); weak medium prismatic structure parting to weak medium subangular blocky; firm; few thin patchy clay films of grayish brown (2.5Y 5/2), dark grayish brown (2.5Y 4/2), and very dark grayish brown (2.5Y 3/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

C—52 to 60 inches; light olive gray (5Y 6/2) silty clay loam; common fine faint mottles of gray (5Y 6/1) and olive gray (5Y 5/2) and common fine distinct mottles of yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), dark reddish brown (5YR 3/4), and very dark gray (10YR 3/1); neutral.

The solum ranges from 36 to 60 inches in thickness.

The Ap or A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) and from medium acid to neutral. The A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and is medium acid or slightly acid. The B2t horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2) and from strongly acid to slightly acid.

Ladoga series

The soils of the Ladoga series are moderately well drained and moderately permeable. These soils are on convex ridgetops and side slopes in the loess-covered uplands and on high, loess-covered stream terraces. The Ladoga soils formed in leached loess under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Ladoga soils are associated on the landscape with Hedrick soils and are similar to Clinton and Otley soils. Hedrick soils have lower chroma in the B2t and B3t horizons and contain less clay in the B horizons than Ladoga soils. Clinton soils have a thinner A1 horizon and a thicker, more distinct A2 horizon. Otley soils have a mollic epipedon and do not have an A2 horizon.

Typical pedon of Ladoga silt loam, 2 to 5 percent slopes, 1,800 feet south and 1,530 feet east of the northwest corner of section 6, T. 73 N., R. 14 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak medium and thick platy structure parting to moderate very fine and fine subangular blocky; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; slightly acid; clear smooth boundary.

B1—11 to 16 inches; brown (10YR 4/3) silty clay loam; moderate very fine and fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; many silt coatings of grayish brown (10YR 5/2) on peds; slightly acid; gradual smooth boundary.

B21t—16 to 20 inches; brown (10YR 4/3) silty clay loam; moderate very fine and fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; thin continuous clay films of dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; medium acid; gradual smooth boundary.

B22t—20 to 25 inches; brown (10YR 4/3) silty clay loam; moderate fine and medium subangular blocky structure; firm; thin continuous clay films of dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; few fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23t—25 to 31 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous clay films of dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; few fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); strongly acid; gradual smooth boundary.

B24t—31 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; common fine and medium faint mottles of grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and dark brown (7.5YR 4/4); moderate medium subangular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2); common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); strongly acid; gradual smooth boundary.

B31t—36 to 45 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of light brownish gray (2.5Y 6/2), grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); medium subangular blocky structure; friable; common thin discontinuous clay films of dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B32t—45 to 54 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint mottles of light brownish gray (2.5Y 6/2), grayish brown (2.5Y 5/2), and yellowish brown (10YR 5/6); weak medium subangular blocky structure; friable; few thin patchy clay films of dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

C—54 to 70 inches; yellowish brown (10YR 5/4) silt loam; common fine faint mottles of light brownish gray (2.5Y 6/2), grayish brown (2.5Y 5/2), and yellowish brown (10YR 5/6); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid.

The solum ranges from 36 to 72 inches in thickness.

The A1 or Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and is medium acid or slightly acid, unless limed. The A2 horizon ranges from strongly acid to slightly acid. The B2t horizon is silty clay loam or silty clay. The C horizon ranges from yellowish brown (10YR 5/4) to olive gray (5Y 5/2) and is silt loam or silty clay loam.

Landes series

The soils of the Landes series are well drained or moderately well drained and have moderately rapid permeability in the upper part and rapid permeability in the lower part. These soils are on bottom land. The Landes soils formed in stratified loamy and sandy alluvium. Slopes range from 0 to 3 percent.

Landes soils are associated on the landscape with Nodaway and Perks soils. Nodaway soils contain less sand and have more silt and clay in the control section than Landes soils. Perks soils contain more sand and have less clay throughout.

Typical pedon of Landes fine sandy loam, 1 to 3 percent slopes, 500 feet south and 2,400 feet west of the northeast corner of section 19, T. 71 N., R. 12 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A12—6 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; very friable; neutral; gradual smooth boundary.

A13—12 to 19 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) fine sandy loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; very friable; neutral; gradual smooth boundary.

C1—19 to 30 inches; brown (10YR 4/3) and dark brown (10YR 3/3) loamy fine sand; massive; very friable; neutral; gradual smooth boundary.

C2—30 to 41 inches; brown (10YR 4/3) and dark brown (10YR 3/3) loamy fine sand; common fine faint mottles of dark grayish brown (10YR 4/2); massive; very friable; neutral; clear smooth boundary.

C3—41 to 56 inches; brown (10YR 5/3) sand; single grain; loose; neutral; gradual smooth boundary.

C4—56 to 72 inches; brown (10YR 4/3) sand; single grain; loose; neutral.

The solum ranges from 10 to 20 inches in thickness.

The A horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), and dark brown (10YR 3/3). It is fine sandy loam, sandy loam, or loamy fine sand. The A horizon is 10 to 20 inches thick. The C horizon is stratified brown (10YR 4/3), dark brown (10YR 3/3), dark gray (10YR 4/1), grayish brown (10YR 5/2 or 2.5Y 5/2), and dark grayish brown (10YR 4/2). It is loamy fine sand, sand, loamy sand, silt loam, and fine sandy loam. The C horizon is neutral or mildly alkaline.

Lindley series

The soils of the Lindley series are well drained and moderately slowly permeable. These soils are on convex, narrow ridgetops and nose slopes and in valley side slopes in the uplands. The Lindley soils formed in glacial till under a native vegetation of deciduous trees. Slopes range from 9 to 40 percent.

Lindley soils are associated on the landscape with Keswick and Weller soils and are similar to Gara soils. Keswick soils have more clay in the Bt horizon than Lindley soils. Weller soils have less sand throughout the solum. Gara soils have a thicker, darker A1 horizon or darker Ap horizon.

Typical pedon of Lindley loam, 18 to 25 percent slopes, 1,620 feet north and 990 feet east of the southwest corner of section 30, T. 71 N., R. 13 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; common fine pebbles; slightly acid; abrupt smooth boundary.

A2—3 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate very fine and thin platy structure parting to weak fine subangular blocky structure; friable; common coatings of dark grayish brown (10YR 4/2) on peds; common fine pebbles; medium acid; gradual smooth boundary.

B1—8 to 11 inches; strong brown (7.5YR 5/6) loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; friable, common thin discontinuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine pebbles; medium acid; gradual smooth boundary.

B21t—11 to 16 inches; yellowish brown (10YR 5/6) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8); common fine pebbles; medium acid; gradual smooth boundary.

B22t—16 to 22 inches; yellowish brown (10YR 5/6) clay loam; common fine faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/4); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and dark gray (10YR 3/1); common fine pebbles; strongly acid; gradual smooth boundary.

B23t—22 to 27 inches; yellowish brown (10YR 5/4 & 5/6) clay loam; common fine faint mottles of grayish brown (10YR 5/2) and brown (10YR 5/3); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); common fine pebbles; strongly acid; gradual smooth boundary.

B3t—27 to 42 inches; yellowish brown (10YR 5/6) clay loam; common fine faint mottles of grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of dark yellowish brown (10YR 4/4) on peds; common fine segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); common fine pebbles; slightly acid; gradual smooth boundary.

C1—42 to 59 inches; yellowish brown (10YR 5/6) loam; common fine faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/4); massive; firm; common fine segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); common fine and medium segregations and concretions of calcium carbonate; common fine pebbles; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—59 to 79 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) loam; common fine faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/4); massive; firm; common fine segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and very dark gray (10YR 3/1); common fine medium segregations and concretions of calcium carbonate; common fine pebbles; violent effervescence; moderately alkaline; abrupt smooth boundary.

The solum ranges from 30 to 50 inches in thickness.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It is loam or clay loam. The A1 horizon is 0 to 4 inches thick and ranges from strongly acid to slightly acid, unless limed. The Ap horizon, if there is one, is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is loam or clay loam. The Ap horizon is 4 to 7 inches thick and ranges from strongly acid to slightly acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). It is loam or clay loam. The A2 horizon ranges from strongly acid to slightly acid. The B2t horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6) and from strongly acid to slightly acid. The C horizon ranges from medium acid to moderately alkaline below a depth of about 3 feet. It is loam or clay loam.

Mahaska series

The soils of the Mahaska series are somewhat poorly drained and moderately permeable. These soils are on the outer edge of moderately broad to broad flats and in the gently sloping coves at the head of drainageways in the loess-covered uplands and on high stream benches. The Mahaska soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 0 to 5 percent.

Mahaska soils are associated on the landscape with the Nira, Otley, and Taintor soils. Nira soils have less clay in the B2t horizon than Mahaska soils. Otley soils have higher chroma and Taintor soils have lower chroma in the B2t horizon.

Typical pedon of Mahaska silty clay loam, 0 to 2 percent slopes, 2,610 feet north and 770 feet east of the southwest corner of section 3, T. 73 N., R. 13 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.

A12—10 to 18 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; common fine faint mottles of very dark grayish brown (10YR 3/2); weak very fine subangular blocky structure parting to moderate fine and medium granular; friable; slightly acid; gradual smooth boundary.

A3—18 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; common fine faint mottles of dark grayish brown (10YR 4/2); moderate very fine subangular blocky structure; friable; many coatings of black (10YR 2/1) on peds; medium acid; gradual smooth boundary.

B21t—23 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint mottles of brown

(10YR 4/3); moderate very fine and fine subangular blocky structure; firm; many coatings of black (10YR 2/1) and very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark gray (10YR 3/1), dark grayish brown (10YR 4/2), and very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

B22t—28 to 37 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; firm; thin continuous clay films of very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), and dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B23t—37 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light brownish gray (2.5Y 6/2), light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate medium subangular blocky structure; firm; thin continuous clay films of very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), and dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B3t—46 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of light brownish gray (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium subangular blocky structure; firm; thin nearly continuous clay films of very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), and dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

C—60 to 70 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct mottles of grayish brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); slightly acid.

The solum ranges from 48 to 72 inches in thickness. The mollic epipedon ranges from 14 to 24 inches thick.

The Ap and A1 horizons are black (10YR 2/1), very dark brown (10YR 2/2), and very dark gray (10YR 3/1). They are silty clay loam or silt loam. The Ap and A1 horizons are 8 to 18 inches thick and are strongly acid or medium acid unless limed. In most pedons there is an A3 horizon. There is a B1 horizon in some pedons. The B2t horizon ranges from dark grayish brown (10YR 4/2) to olive brown (2.5Y 4/4) to grayish brown (2.5Y 5/2). It is silty clay or silty clay loam and is strongly acid or medium acid. The C horizon is silt loam or silty clay loam.

Mystic series

The soils of the Mystic series are moderately well drained or somewhat poorly drained and slowly permeable. They are on high stream benches. They formed in moderately fine and fine stratified, water-sorted glacial sediments deposited as alluvium during an early geological period. These soils developed under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

Mystic soils are associated on the landscape with Caleb and Gara soils and are similar to Galland soils. Caleb and Gara soils have less clay in the B2t horizon than Mystic soils. Gara soils are developed from glacial till and do not have stratification throughout. Galland soils have a thinner dark-colored A1 horizon or lighter colored Ap horizon.

Typical pedon of Mystic silt loam, 9 to 14 percent slopes, moderately eroded, 1,430 feet south and 20 feet west of the northeast corner of section 26, T. 73 N., R. 13 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; some brown (10YR 4/3) clay loam is mixed into the plow layer; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

B1—8 to 16 inches; brown (10YR 4/3) clay loam; common fine distinct mottles of reddish brown (5YR 4/4), yellowish red (5YR 4/6 & 4/8), strong brown (7.5YR 5/6), dark yellowish brown (10YR 4/4), and dark grayish brown (10YR 4/2); moderate fine and medium subangular blocky structure; friable; common thin discontinuous clay films of dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) on peds; common fine segregations and concretions (iron oxides) of reddish brown (5YR 4/4) and yellowish red (5YR 4/6 & 4/8); medium acid; gradual smooth boundary.

B21t—16 to 24 inches; brown (10YR 4/3) clay loam; common fine distinct mottles of reddish brown (5YR 4/4), yellowish red (5YR 4/6 & 4/8), strong brown (7.5YR 5/6), brown (7.5YR 4/4), dark yellowish brown (10YR 4/4), and dark grayish brown (10YR 4/2); weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous clay films of dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B22t—24 to 35 inches; brown (10YR 5/3) clay loam; common fine faint mottles of brown (10YR 4/3), grayish brown (10YR 5/2), and yellowish brown (10YR 5/4); weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin nearly continuous clay films of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B23t—35 to 51 inches; brown (7.5YR 5/4) clay loam; common fine faint mottles of yellowish brown (10YR 5/4 & 5/6) and strong brown (7.5YR 5/6); weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common thin discontinuous clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8), reddish brown (5YR 4/4), and very dark gray (10YR 3/1); medium acid; clear smooth boundary.

B3t—51 to 58 inches; brown (7.5YR 5/4) sandy clay loam; common fine faint mottles of yellowish brown (10YR 5/4 & 5/6); weak medium subangular blocky structure; friable; few thin patchy clay films of grayish brown (10YR 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); few small pebbles; slightly acid; clear smooth boundary.

C—58 to 65 inches; yellowish brown (10YR 5/4) sandy clay loam; common fine faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); massive; friable; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is silt loam, loam, or clay loam. The A1 or Ap horizon is 7 to 9 inches thick and is strongly acid or medium acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3 or 7.5YR 5/2). It is silt loam, loam, or clay loam. The A2 horizon ranges from strongly acid to medium acid, unless limed. The B2t horizon ranges from dark grayish brown (2.5Y 4/2) to brown (7.5YR 5/4). It is clay loam, clay, or silty clay. The B2t horizon ranges from very strongly acid to medium acid.

Mystic Variant

The soils of the Mystic Variant are somewhat poorly drained or poorly drained and very slowly permeable. They are on high stream benches. They formed in moderately fine and fine, stratified, water-sorted, glacial sediments deposited as alluvium during an earlier geological period. These soils developed under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 7 to 12 percent.

Mystic Variant soils are associated on the landscape with Caleb, Gara, and Mystic soils and are similar to Galland soils. Caleb, Gara, and Mystic soils have less clay in the B2t horizon than Mystic Variant soils. Gara soils are developed from glacial till and do not have stratification throughout. The Mystic soils have higher chroma in the B2t horizon. Galland soils have a thinner dark-colored A1 horizon or a lighter colored Ap horizon.

Typical pedon of Mystic Variant silty clay loam, 7 to 12 percent slopes, moderately eroded, 60 feet south and 900 feet east of the northwest corner of section 21, T. 73 N., R. 13 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; some brown (10YR 4/3) clay loam is mixed into the plow layer; weak very fine and fine granular structure; friable; medium acid; abrupt smooth boundary.

B11t—7 to 14 inches; dark grayish brown (10YR 4/2) clay loam; common fine distinct mottles of brown (10YR 4/3), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6 & 5/8); moderate fine and medium subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) on peds; medium acid; clear smooth boundary.

B12t—14 to 18 inches; dark grayish brown (10YR 4/2) clay loam; common fine distinct mottles of brown (10YR 4/3), yellowish brown (10YR 5/6 & 5/8), and strong brown (7.5YR 5/6); moderate fine subangular blocky structure; friable; thin nearly continuous clay films of dark grayish brown (10YR 4/2) on peds; few silt coatings of light brownish gray (10YR 6/2) on peds; medium acid; gradual smooth boundary.

IIB21t—18 to 22 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/6 & 5/8); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of dark grayish brown (10YR 4/2) on peds; few silt coatings of light brownish gray (10YR 6/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

IIB22t—22 to 26 inches; grayish brown (2.5YR 5/2) clay loam; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/6 & 5/8); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of gray (10YR 5/1 & 5Y 5/1) on peds; few silt coatings of light brownish gray (10YR 6/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; clear smooth boundary.

IIB23t—26 to 36 inches; grayish brown (2.5Y 5/2) clay; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/6 & 5/8); moderate fine subangular blocky structure; very firm; common thin discontinuous clay films of gray (5Y 5/1 & 10YR 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

IIB24t—36 to 42 inches; light brownish gray (2.5Y 6/2) clay; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/6 & 5/8); moderate fine subangular blocky structure; very firm; thin nearly continuous clay films of grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

IIB25t—42 to 48 inches; light brownish gray (2.5Y 6/2) clay; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/6 & 5/8); moderate fine subangular blocky structure; very firm; thin nearly continuous clay films of grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

IIB26t—48 to 58 inches; grayish brown (2.5YR 5/2) clay; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/8); moderate fine subangular blocky structure; very firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

IIB27t—58 to 68 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct mottles of yellowish brown (10YR 5/6 & 5/8) and strong brown (7.5YR 5/8); moderate fine subangular blocky structure; firm; thin nearly continuous clay films of gray (5Y 5/1) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6 & 5/8) and very dark gray (10YR 3/1); neutral; gradual smooth boundary.

The solum ranges from 48 to 84 inches in thickness.

The Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and is strongly acid or medium acid, unless limed. The IIB2t horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (2.5Y 6/2). It is strongly acid or medium acid in the upper part.

Nevin series

The soils of the Nevin series are somewhat poorly drained and moderately permeable. They are on low stream terraces. They formed in silty alluvium under a native vegetation of prairie grasses. Slopes,range from 0 to 2 percent.

Nevin soils are associated on the landscape with Richwood and Wiota soils and are similar to Koszta soils. Richwood soils have higher chroma and less clay in the Bt horizon than Nevin soils. Wiota soils have higher chroma in the Bt horizon. Koszta soils do not have a mollic epipedon and have an A2 horizon.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, 1,500 feet south and 80 feet east of the northwest corner of section 28, T. 71 N., R. 12 W.

Ap—0 to 11 inches; very dark brown (10YR 2/2) silty clay loam; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A3—11 to 19 inches; very dark brown (10YR 2/2) silty clay loam; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; friable; neutral; gradual smooth boundary.

B1t—19 to 25 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine faint mottles of dark grayish brown (10YR 4/2); moderate medium prismatic structure parting to moderate very fine and fine subangular blocky; friable; common coatings of very dark brown (10YR 2/2) on peds; neutral; gradual smooth boundary.

B21t—25 to 35 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint mottles of brown (10YR 4/3) and yellowish brown (10YR 5/6); moderate medium prismatic structure parting to moderate fine subangular blocky; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) on peds; few fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); slightly acid; gradual smooth boundary.

B22t—35 to 46 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct mottles of dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and dark gray (7.5YR 4/1); moderate medium prismatic structure parting to moderate fine subangular blocky; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) on peds;

common thin discontinuous clay films of dark brown (10YR 3/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); slightly acid; gradual smooth boundary.

B3t—46 to 56 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct mottles of grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak medium prismatic structure parting to weak medium subangular blocky; friable; few coatings of very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) on peds; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

C—56 to 72 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of dark grayish brown (2.5Y 4/2), light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); slightly acid.

The solum ranges from 36 to 60 inches in thickness.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is silty clay loam or silt loam. The A horizon is 18 to 30 inches thick and ranges from medium acid to neutral. The B2t horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2) and is medium acid or slightly acid.

Nira series

The soils of the Nira series are moderately well drained and moderately permeable. These soils are on short, convex side slopes and in coves at the heads of drainageways in the loess-covered uplands. The Nira soils formed in deoxidized leached loess under a native vegetation of tall prairie grasses. Slopes range from 5 to 9 percent.

Nira soils are associated on the landscape with Mahaska and Otley soils and are similar to Hedrick soils. Mahaska and Otley soils have more clay in the B2t horizon than Nira soils. Otley soils have higher chroma in the lower part of the B2t horizon and in the B3t horizon. Hedrick soils do not have a mollic epipedon.

Typical pedon of Nira silty clay loam, 5 to 9 percent slopes, 600 feet north and 1,260 feet east of the southwest corner of section 17, T. 73 N., R. 13 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A3—8 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, gray (10YR 5/1) dry; few fine faint mottles of brown (10YR 4/3) and yellowish brown (10YR 5/6); moderate very fine subangular blocky structure; friable; many coatings of very dark gray (10YR 3/1) on peds; medium acid; gradual smooth boundary.

B21t—12 to 17 inches; brown (10YR 4/3) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/4), and dark grayish brown (2.5Y 4/2); moderate very fine and fine subangular blocky structure; friable; common coatings of very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) on peds; few fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B22t—17 to 24 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2), light brownish gray (2.5Y 6/2), and light olive brown (2.5Y 5/4); common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); moderate fine subangular blocky structure; firm; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2), dark grayish brown (2.5Y 4/2), and grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

B23t—24 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2); common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), brown (7.5YR 4/4), and dark reddish brown (5YR 3/4); moderate fine and medium subangular blocky structure; friable; common thin discontinuous clay films of very dark grayish brown (2.5Y 3/2), dark grayish brown (2.5Y 4/2), and grayish brown (2.5Y 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/4); medium acid; gradual smooth boundary.

B31t—30 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2); common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), dark brown (7.5YR 4/4), and dark reddish brown (5Y 3/4); weak medium subangular blocky structure; friable; few thin patchy clay films of dark grayish brown (2.5Y 4/2), grayish brown (2.5Y 5/2), and very dark grayish brown (2.5Y 3/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/4); medium acid; gradual smooth boundary.

B32t—42 to 48 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint mottles of grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2); common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), brown (7.5YR 4/4), and dark reddish brown (5YR 3/4); moderate medium subangular blocky structure; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/4); medium acid; gradual smooth boundary.

C—48 to 60 inches; olive gray (5Y 5/2) silt loam; common fine faint mottles of light olive gray (5Y 6/2), grayish brown (2.5Y 5/2), light brownish gray (2.5Y 6/2), and dark grayish brown (2.5Y 4/2); common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), brown (7.5YR 4/4), and dark reddish brown (5YR 3/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/4); medium acid.

The solum ranges from 30 to 50 inches in thickness. The mollic epipedon ranges from 10 to 16 inches thick.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 10 to 15 inches thick and is medium acid or slightly acid, unless limed. The B21t horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). The B31t horizon ranges from gray (2.5YR 5/1) to light olive gray (5Y 6/2) and is medium acid or slightly acid. The gray colors in the B3 and C horizons are relict features.

The Nira soils in map unit 581C2 do not have a mollic epipedon as is defined in the range for the Nira series.

Nodaway series

The Nodaway series consists of moderately well drained, moderately permeable soils on bottom land. These soils formed in stratified silty alluvium. Slopes range from 0 to 3 percent.

Nodaway soils are associated on the landscape with Colo, Cantril, Landes, and Perks soils. Colo soils have a mollic epipedon and contain more clay in the control section than Nodaway soils. Cantril soils have an argillic horizon and contain more clay and sand in the control section. Landes and Perks soils contain less clay and more sand in their control sections.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, 1,340 feet north and 2,540 feet west of the southeast corner of section 34, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; friable; neutral; clear smooth boundary.

C1—8 to 46 inches; stratified dark grayish brown (10YR 4/2), brown (10YR 4/3), and grayish brown (10YR 5/2) silt loam; massive, but tending to weak thin platy structure because of stratification; friable; few thin strata of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) silt loam; neutral; gradual smooth boundary.

C2—46 to 64 inches; stratified brown (10YR 4/3) and dark grayish brown (10YR 4/2) silt loam; common fine faint mottles of grayish brown (10YR 5/2) and dark brown (10YR 3/3); massive; friable; slightly acid.

The solum ranges from 6 to 10 inches in thickness.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick and is slightly acid or neutral. The C horizon is stratified dark grayish brown (10YR 4/2), dark brown (10YR 3/3), brown (10YR 4/3), grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It is stratified silt loam that contains thin strata of silty clay loam, loam, sandy loam, and clay loam.

Otley series

The soils of the Otley series are moderately well drained and moderately permeable. They are on convex ridgetops and upper side slopes in the loess-covered uplands and on high stream benches. The Otley soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 2 to 9 percent.

Otley soils are associated on the landscape with Mahaska and Nira soils and are similar to Clinton and Ladoga soils. Mahaska soils have lower chroma in the B2t horizon than Otley soils. Nira soils contain less clay in the B2t horizon and have lower chroma in the lower part of the B2t layer and in the B3t horizon. Clinton and Ladoga soils do not have a mollic epipedon.

Typical pedon of Otley silty clay loam, 2 to 5 percent slopes, 150 feet south and 2,580 feet west of the northeast corner of section 11, T. 73 N., R. 12 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 12 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine subangular blocky structure parting to moderate very fine and fine granular; friable; common coatings of very dark brown (10YR 2/2) on peds; strongly acid; gradual smooth boundary.

A3—12 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; common coatings of very dark brown (10YR 2/2) and black (10YR 2/1) on peds; strongly acid; gradual smooth boundary.

B1—16 to 21 inches; brown (10YR 4/3) silty clay loam; moderate very fine subangular blocky structure; firm; common coatings of very dark grayish brown (10YR 3/2) on peds; strongly acid; gradual smooth boundary.

B21t—21 to 31 inches; brown (10YR 4/3) silty clay loam; few fine faint mottles of yellowish brown (10YR 5/6); weak medium prismatic structure parting to moderate very fine and fine subangular blocky; firm; common coatings of dark brown (10YR 3/3) on peds; common thin discontinuous clay films of dark brown (10YR 3/3) on peds; strongly acid; gradual smooth boundary.

B22t—31 to 40 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6); weak medium prismatic structure parting to weak fine and medium subangular blocky; firm; common thin discontinuous clay films of dark brown (10YR 3/3) on peds; common fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B3t—40 to 54 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6); weak medium prismatic structure parting to weak medium subangular blocky; friable; common thin discontinuous clay films of dark brown (10YR 3/3) on peds; common fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

C—54 to 60 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; common fine distinct mottles of strong brown (7.5YR 5/6 & 5/8); massive; friable; common fine segregations (iron and manganese oxides) of yellowish brown (10YR 5/6 & 5/8) and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness. The mollic epipedon ranges from 10 to 20 inches thick.

The A horizon ranges from black (10YR 2/1) to dark brown (10YR 3/3). It is 10 to 20 inches thick. The reaction of the A horizon is strongly acid or medium acid, unless limed. The B2t horizon is silty clay loam or silty clay. It is strongly acid or medium acid. The B3t horizon ranges from dark gray (2.5Y 4/2) to light olive gray (5Y 6/2) to yellowish brown (10YR 5/6). It ranges from strongly acid to slightly acid.

The Otley soils in map units 581C2 and 881C2 do not have a mollic epipedon as is defined in the range for the Otley series.

Perks series

The soils of the Perks series are excessively drained and rapidly permeable. They are on bottom land. The Perks soils formed in sandy alluvium. Native vegetation consisted of cottonwoods, elm, willows, and some hardwoods. Slopes range from 1 to 3 percent.

Perks soils are associated on the landscape with Landes and Nodaway soils. Landes and Nodaway soils have less sand and more clay in the control section than Perks soils. Landes soils have a mollic epipedon. Nodaway soils contain more silt in the control section.

Typical pedon of Perks loamy sand from an area of Landes-Perks-Nodaway complex, 1 to 3 percent slopes, 1,100 feet north and 1,580 feet east of the southwest corner of section 13, T. 71 N., R. 13 W.

A1—0 to 9 inches; dark brown (10YR 4/3) loamy sand, brown (10YR 5/3) dry; very weak fine granular structure parting to single grain; loose; medium acid; clear smooth boundary.

C1—9 to 37 inches; brown (10YR 5/3) sand; single grain; loose; few thin strata of dark brown (10YR 4/3) sandy loam; medium acid; clear smooth boundary.

C2—37 to 48 inches; dark brown (10YR 4/3) loamy sand; common fine faint mottles of dark grayish brown (10YR 4/2) and brown (10YR 5/3); very weak medium subangular blocky structure parting to single grain; very friable to loose; few thin strata of dark brown (10YR 4/3) sandy loam; medium acid; clear smooth boundary.

C3—48 to 58 inches; brown (10YR 5/3) loamy sand; single grain; loose; medium acid; clear smooth boundary.

C4—58 to 72 inches; dark brown (10YR 4/3) loamy sand; common fine and medium distinct mottles of brown (10YR 5/3); single grain; loose; slightly acid.

The solum ranges from 5 to 9 inches in thickness.

The A horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3). It is 5 to 9 inches thick and is medium acid, unless limed. The C horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6).

Pershing series

The soils of the Pershing series are somewhat poorly drained or moderately well drained and slowly permeable. They are on convex side slopes and convex ridgetops in the loess-covered uplands and are on high stream terraces. The Pershing soils formed in leached loess under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Pershing soils are associated on the landscape with Belinda, Grundy, and Weller soils. Belinda soils have lower chroma in the B2t horizon than Pershing soils. Grundy soils have a mollic epipedon and lack an A2 horizon. Weller soils have a lighter colored Ap horizon or a thinner dark A1 horizon.

Typical pedon of Pershing silt loam, 2 to 5 percent slopes, 470 feet south and 350 feet west of the northeast corner of section 36, T. 72 N., R. 15 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; friable; slightly acid; clear smooth boundary.

A2—7 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; common fine faint mottles of brown (10YR 4/3); weak medium platy structure parting to weak fine subangular blocky; friable; common discontinuous coatings of very dark grayish brown (10YR 3/2) on peds; medium acid; clear smooth boundary.

B1t—9 to 13 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silty clay loam; moderate very fine and fine subangular blocky structure; firm; few discontinuous coatings of very dark grayish brown (10YR 3/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; medium acid; clear smooth boundary.

B21t—13 to 19 inches; dark grayish brown (10YR 4/2) silty clay; common fine faint and distinct mottles of brown (10YR 4/3) and dark yellowish brown (10YR 4/4); strong very fine and fine subangular blocky structure; very firm; many thin patchy clay films of dark grayish brown (10YR 4/2) on peds; common silt coatings of grayish brown (10YR 5/2) on peds; few fine segregations (iron and manganese oxides) of dark yellowish brown (10YR 4/4) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B22t—19 to 26 inches; grayish brown (10YR 5/2) silty clay; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; very firm; common thin patchy clay films of dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B23t—26 to 32 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint and distinct mottles of dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6), and brown (7.5YR 4/4); moderate fine and medium subangular blocky structure; firm; common thin patchy clay films of dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); strongly acid; gradual smooth boundary.

B31t—32 to 38 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint and distinct mottles of grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/6); weak medium subangular blocky structure; firm; common thin patchy clay films of dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6) and very dark gray (10YR 3/1); very strongly acid; gradual smooth boundary.

B32t—38 to 56 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint and distinct mottles of grayish brown (2.5Y 5/2), brown (7.5YR 4/4), and strong brown (7.5YR 5/6); weak medium subangular blocky structure; firm; common thin patchy clay films of dark grayish brown (10YR 4/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 5/4), and very dark gray (10YR 3/1); very strongly acid; gradual smooth boundary.

C—56 to 72 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine faint and distinct mottles of grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and brown (7.5YR 4/4); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 5/4), and very dark gray (10YR 3/1); medium acid.

The solum ranges from 48 to 72 inches or more in thickness.

The Ap or A1 horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). Texture of the Ap horizon is silt loam or silty clay loam. The Ap or A1 horizon is 7 to 9 inches thick and ranges from strongly acid to slightly acid, unless limed. The A2 horizon, if there is one, ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2). It ranges from very strongly acid to slightly acid. The B1 horizon may be present in some pedons. The B2t horizon ranges form very strongly acid to medium acid. The C horizon is silty clay loam or silt loam.

Richwood series

The soils of the Richwood series are well drained and moderately permeable. They are on low stream terraces. The Richwood soils formed in silty and loamy alluvium under a native vegetation of prairie grasses. Slopes range from 0 to 5 percent.

Richwood soils are associated on the landscape with Nevin soils and are similar to Wiota soils. Nevin soils have more clay and lower chroma in the B horizon than Richwood soils. Wiota soils have more clay in the B horizon.

Typical pedon of Richwood silt loam, 0 to 2 percent slopes, 5 feet south and 1,750 feet east of the northwest corner of section 29, T. 71 N., R. 12 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common fine faint mottles of very dark gray (10YR 3/1); moderate very fine and fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; continuous coatings of very dark gray (10YR 3/1) on peds; slightly acid; gradual smooth boundary.

A3—10 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; continuous coatings of very dark gray (10YR 3/1) on peds; slightly acid; gradual smooth boundary.

B1t—15 to 23 inches; dark brown (10YR 3/3) silt loam; moderate fine subangular blocky structure; friable; common discontinuous coatings of very dark gray (10YR 3/1) on peds; common very thin discontinuous clay films of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; slightly acid; gradual smooth boundary.

B21t—23 to 29 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; common discontinuous coatings of dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), and very dark gray (10YR 3/1) on peds; common very thin discontinuous clay films of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; slightly acid; gradual smooth boundary.

B22t—29 to 33 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; common discontinuous coatings of dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), and very dark gray (10YR 3/1) on peds; common very thin discontinuous clay films of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; slightly acid; gradual smooth boundary.

B31t—33 to 40 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common discontinuous coatings of dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), and very dark gray (10YR 3/1) on peds; few very thin discontinuous clay films of dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

IIB32t—40 to 45 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common discontinuous coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; few very thin discontinuous clay films of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

IIC—45 to 60 inches; brown (10YR 4/3) loam; common fine faint mottles of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2); massive; friable; neutral.

The solum ranges from 40 to 65 inches in thickness.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 10 to 20 inches thick and ranges from medium acid to neutral. The B2t horizon ranges from dark brown (10YR 3/3) to dark yellowish brown (10YR 4/4). It is silt loam or silty clay loam. The B2t horizon ranges from medium acid to neutral.

Richwood Variant

The soils of the Richwood Variant are well drained and moderately permeable. They are on low to very low stream terraces. The Richwood Variant soils formed in loamy alluvium under a native vegetation of prairie grasses. Slopes range from 1 to 3 percent.

Richwood Variant soils are associated on the landscape with Nevin, Richwood, and Wiota soils. Nevin soils have more clay and less sand throughout the solum and have lower chroma in the B horizon than Richwood Variant soils. Richwood soils have less sand throughout the solum. Wiota soils have less sand and more clay throughout the solum.

Typical pedon of Richwood Variant loam, 1 to 3 percent slopes, 2,380 feet north and 1,150 feet west of the southeast corner of section 28, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure parting to moderate fine granular; friable; common coatings of very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

A3—14 to 22 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few fine faint mottles of dark brown (10YR 3/3); weak very fine and fine subangular blocky structure parting to moderate fine granular; friable; common coatings of very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

B1—22 to 27 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; common fine faint mottles of dark brown (10YR 3/3); weak very fine and fine subangular blocky structure; friable; few coatings of very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

B21t—27 to 35 inches; dark brown (10YR 3/3) loam; weak very fine and fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) on peds; neutral; gradual smooth boundary.

B22t—35 to 44 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; neutral; gradual smooth boundary.

B3—44 to 49 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; neutral; gradual smooth boundary.

C—49 to 60 inches; dark yellowish brown (10YR 4/4) loam; very weak medium subangular blocky structure; friable common coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; neutral.

The solum ranges from 40 to 60 inches in thickness. The mollic epipedon ranges from 18 to 30 inches thick.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 10 to 24 inches thick and ranges from medium acid to neutral. The B1 horizon ranges from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4). It is loam or silt loam and ranges from medium acid to neutral. The C horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4). It is loam or sandy loam and is slightly acid or neutral.

Rinda series

The soils of the Rinda series are poorly drained or somewhat poorly drained and very slowly permeable. They are on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways in the uplands. The Rinda soils formed in a Paleosol weathered from glacial till under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

Rinda soils are associated on the landscape with Armstrong, Gara, and Pershing soils and are similar to Ashgrove and Clarinda soils. Armstrong soils contain less clay and have higher chroma in the IIB2t horizon than Rinda soils. Pershing soils contain more silt and less clay and sand and have higher chroma in the B2t horizon. Gara soils contain less clay and have higher chroma in the B2t horizon. Ashgrove soils have a lighter colored Ap horizon or thinner dark-colored A1 horizon. Clarinda soils have a mollic epipedon.

Typical pedon of Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded, 2,175 feet north and 1,650 feet east of the southwest corner of section 30, T. 71 N., R. 15 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; some dark grayish brown (10YR 4/2) clay is mixed into the plow layer; moderate fine and medium granular structure; friable; medium acid; clear smooth boundary.

B1t—7 to 10 inches; dark grayish brown (10YR 4/2) clay; common fine distinct mottles of brown (7.5YR 4/4) and strong brown (7.5YR 5/6); moderate very fine and fine subangular blocky structure; very firm; common discontinuous coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of dark grayish brown (10YR 4/2) on peds; few fine segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and black (10YR 2/1); medium acid; gradual smooth boundary.

B21t—10 to 20 inches; dark grayish brown (2.5Y 4/2) clay; common fine distinct mottles of brown (7.5YR 4/4), strong brown (7.5YR 5/6), gray (5Y 5/1), and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; very firm; common discontinuous coatings of very dark grayish brown (2.5Y 3/2) on peds; thin nearly continuous clay films of dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) on peds; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and black (10YR 2/1); medium acid; gradual smooth boundary.

B22t—20 to 28 inches; dark grayish brown (2.5Y 4/2) clay; common fine distinct mottles of brown (7.5YR 4/4), strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and gray (5Y 5/1); weak fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) on peds; common segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and black (10YR 2/1); neutral; gradual smooth boundary.

B31t—28 to 35 inches; grayish brown (2.5Y 5/2) clay; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), brown (7.5YR 4/4), olive brown (2.5Y 4/4), and gray (5Y 5/1); weak medium subangular blocky structure; very firm; thin nearly continuous clay films of grayish brown (2.5Y 5/2) on peds; common segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and black (10YR 2/1); mildly alkaline; abrupt smooth boundary.

B32t—35 to 44 inches; gray (5Y 6/1) clay; many fine and medium distinct mottles of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and gray (5Y 5/1); weak medium subangular blocky structure; very firm; common thin discontinuous clay films of gray (5Y 5/1 & 6/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), yellowish red (5YR 4/6), and very dark gray (10YR 3/1); common fine and medium segregations and concretions of calcium carbonate; mildly alkaline; clear smooth boundary.

C1—44 to 50 inches; gray (5Y 6/1) clay; common fine and medium distinct mottles of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and gray (5Y 5/1); massive; firm; common fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), yellowish red (5YR 4/6), and very dark gray (10YR 3/1); common fine and medium segregations and concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

C2—50 to 60 inches; gray (5Y 6/1) clay; common fine and medium distinct mottles of brown (7.5YR 4/4); massive; firm; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), yellowish red (5YR 4/6), and black (10YR 2/1); common very fine and fine segregations and concretions of calcium carbonate; moderately alkaline.

The solum ranges from 42 to 84 inches in thickness. The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and is medium acid or slightly acid, unless limed. The B2t horizon ranges from dark grayish brown (10YR 4/2) and gray (5Y 5/1) to light olive gray (5Y 6/2). The B21t horizon ranges from very strongly acid to neutral.

Shelby series

The soils of the Shelby series are moderately well drained and moderately slowly permeable. They are on short, convex, valley side slopes in the uplands. The Shelby soils formed in glacial till under a native vegetation of tall prairie grasses. Slopes range from 9 to 14 percent.

Shelby soils are associated on the landscape with Adair soils and are similar to Gara and Lindley soils. Adair soils have more clay in the B horizon than Shelby soils. Gara and Lindley soils do not have a mollic epipedon.

Typical pedon of Shelby clay loam from an area of Shelby-Adair clay loams, 9 to 14 percent slopes, moderately eroded, 1,100 feet north and 2,200 feet east of the southwest corner of section 28, T. 73 N., R. 12 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; some brown (10YR 4/3) clay loam is mixed into the plow layer; common fine faint mottles of dark brown (10YR 3/3) and brown (10YR 4/3); weak fine granular structure; friable; medium acid; clear smooth boundary.

B21t—7 to 15 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark brown (10YR 3/3), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/4); weak fine and medium subangular blocky structure; firm; common thin discontinuous clay films of very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) on peds; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common medium and large pebbles; medium acid; gradual smooth boundary.

B22t—15 to 22 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of dark brown (10YR 3/3) and dark grayish brown (10YR 4/2) on peds; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common medium and large pebbles; medium acid; gradual smooth boundary.

B31t—22 to 33 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4); moderate medium subangular blocky structure; firm; common thin discontinuous clay films of brown (10YR 4/3) on peds; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common medium and large pebbles; slightly acid; gradual smooth boundary.

B32t—33 to 42 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4); moderate medium subangular blocky structure; firm; common thin discontinuous clay films of brown (10YR 4/3) on peds; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common medium and large pebbles; neutral; gradual smooth boundary.

C1—42 to 58 inches; brown (10YR 4/3) and grayish brown (2.5Y 5/2) clay loam; common fine faint mottles of yellowish brown (10YR 5/4); massive; firm; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common fine and medium pebbles; neutral; gradual smooth boundary.

C2—58 to 72 inches; brown (10YR 4/3) clay loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4); massive; firm; common fine segregations (iron oxides) of yellowish brown (10YR 5/4 & 5/6); common fine and medium segregations and concretions of calcium carbonates; common fine and medium pebbles; strong effervescence; moderately alkaline.

The solum ranges from 40 to 50 inches in thickness. The soil is commonly calcareous at depths of 40 to 60 inches.

The Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2). It is clay loam, silty clay loam, and loam. The Ap horizon is strongly acid or medium acid, unless limed. The B2t horizon is brown (10YR 4/3), dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), or dark brown (10YR 3/3). It is strongly acid or medium acid.

The Shelby soils in the county, due to erosion, do not have a mollic epipedon as is defined in the range for the Shelby series.

Sparta series

The soils of the Sparta series are excessively drained and rapidly permeable. They are on both low and high stream benches along the Des Moines River. The Sparta soils formed in sandy alluvium which is wind-reworked in many places under a native vegetation of prairie grasses. Slopes range from 1 to 20 percent.

Sparta soils are associated on the landscape with Clinton, Hoopeston, and Waukee soils. Clinton soils are associated with Sparta soils on the high benches. Clinton soils do not have a mollic epipedon, have an A2 horizon, and have more silt and clay and less sand throughtout the solum than Sparta soils. Hoopeston and Waukee soils are associated with Sparta soils on the low benches. Hoopeston soils have more clay throughout the solum and have lower chroma in the B horizon. Waukee soils have more clay and less sand throughout the solum.

Typical pedon of Sparta loamy fine sand, 4 to 10 percent slopes, 1,250 feet north and 20 feet east of the southwest corner of section 5, T. 73 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; neutral; clear smooth boundary.

A3—8 to 15 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B21—15 to 28 inches; dark brown (10YR 3/3) loamy fine sand; weak medium and coarse subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B22—28 to 39 inches; brown (10YR 4/3) loamy fine sand; weak medium and coarse subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C—39 to 60 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; medium acid.

The solum ranges from 24 to 40 inches in thickness. The mollic epipedon ranges from 10 to 24 inches thick.

The Ap or A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is loamy fine sand or loamy sand. The A horizon is 10 to 18 inches thick and is medium acid, unless limed. The B2 horizon ranges from dark brown (10YR 3/3) to yellowish brown (10YR 5/4). It is sand, fine sand, loamy sand, or loamy fine sand. The C horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6). It is fine sand or sand.

Sperry series

The soils of the Sperry series are very poorly drained or poorly drained and slowly permeable. They are on broad upland divides in slight depressions. The Sperry soils formed in leached loess under a native vegetation of sedges and prairie grasses. Slopes range from 0 to 1 percent.

Sperry soils are associated on the landscape with Taintor soils and are similar to Edina and Haig soils. Taintor soils have less clay in the B2t horizon and do not have an A2 horizon. Edina soils have more clay in the B2t horizon than Sperry soils. Haig soils do not have an A2 horizon.

Typical pedon of Sperry silt loam, 0 to 1 percent slopes, 100 feet south and 120 feet east of the northwest corner of section 12, T. 73 N., R. 12 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A21—10 to 16 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak medium platy structure parting to moderate very fine and fine subangular blocky; friable; many silt coatings of light gray (10YR 7/2 dry) on peds; medium acid; clear smooth boundary.

A22—16 to 20 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; moderate fine subangular blocky structure; friable; few thin patchy clay films of dark gray (10YR 4/1) on peds; common silt coatings of light gray (10YR 7/2 dry) on peds; medium acid; gradual smooth boundary.

B21gt—20 to 27 inches; dark gray (10YR 4/1) silty clay; many fine and medium distinct mottles of yellowish brown (10YR 5/6 & 5/8); weak medium prismatic structure parting to moderate very fine and fine subangular blocky; very firm; few coatings of very dark gray (10YR 3/1) on peds; thin continuous clay films of dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6) and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B22gt—27 to 34 inches; grayish brown (2.5Y 5/2) silty clay; many fine and medium distinct mottles of yellowish brown (10YR 5/6 & 5/8); weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin continuous clay films of dark gray (10YR 4/1) on peds; common fine segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); medium acid; gradual smooth boundary.

B23gt—34 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine and medium distinct mottles of yellowish brown (10YR 5/6); weak medium prismatic structure parting to weak fine and medium subangular blocky; firm; thin continuous clay films of dark gray (10YR 4/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); medium acid; gradual smooth boundary.

B3gt—41 to 52 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium distinct mottles of yellowish brown (10YR 5/6); weak medium prismatic structure parting to weak medium subangular blocky; firm; few thin patchy clay films of dark gray (10YR 4/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); slightly acid; gradual smooth boundary.

Cg—52 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium distinct mottles of yellowish brown (10YR 5/6); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of yellowish brown (10YR 5/6), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); neutral.

The solum ranges from 40 to 68 inches in thickness. The mollic epipedon ranges from 10 to 12 inches thick.

The Ap or A1 horizon or both are black (10YR 2/1) or very dark gray (10YR 3/1). Singly or combined, they are 10 to 12 inches thick and are medium acid or slightly acid, unless limed. The A2 horizon ranges from strongly acid to slightly acid. The B2t horizon ranges from dark gray (10YR 4/1) to light brownish gray (2.5Y 6/2) to gray (5Y 5/1). It ranges from strongly acid to slightly acid.

Taintor series

The soils of the Taintor series are poorly drained and have moderately slow permeability. These soils are on broad flats on the loess-covered upland divides and on high stream benches. The Taintor soils formed in leached loess under a native vegetation of tall prairie grasses. Slopes range from 0 to 2 percent.

Taintor soils are associated on the landscape with Kalona, Mahaska, and Sperry soils and are similar to Haig soils. Kalona soils have more clay in the Ap horizon and do not have an argillic B horizon. Mahaska soils have higher chroma in the B horizon than Taintor soils. Sperry soils have more clay in the B2t horizon and have an A2 horizon. Haig soils have more clay in the B2t horizon.

Typical pedon of Taintor silty clay loam, 0 to 2 percent slopes, 2,530 feet south and 1,520 feet west of the northeast corner of section 15, T. 73 N., R. 13 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—9 to 16 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure parting to moderate fine and medium granular; friable; common coatings of black (10YR 2/1) on peds; neutral; gradual smooth boundary.

A3—16 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; common fine distinct mottles of yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); common fine faint mottles of dark gray (10YR 4/1); moderate very fine subangular blocky structure; firm; common coatings of black (10YR 2/1) on peds; common fine segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); slightly acid; gradual smooth boundary.

B21t—20 to 24 inches; dark gray (10YR 4/1) silty clay; common fine distinct mottles of yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); moderate very fine and fine subangular blocky structure; firm; common coatings of very dark gray (10YR 3/1) and black (10YR 2/1) on peds; thin continuous clay films of dark gray (10YR 4/1) and very dark gray (10YR 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); slightly acid; gradual smooth boundary.

B22t—24 to 28 inches; gray (5Y 5/1) silty clay; common fine faint mottles of gray (5Y 5/2) and dark gray (5Y 4/1); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); moderate very fine and fine subangular blocky structure; firm; thin continuous clay films of dark gray (5Y 4/1), gray (5Y 5/1), and very dark gray (5Y 3/1) on peds; common fine segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); slightly acid; gradual smooth boundary.

B31t—28 to 36 inches; gray (5Y 5/1) silty clay loam; common fine faint mottles of olive gray (5Y 5/2) and dark gray (5Y 5/2 & 4/1); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), dark yellowish brown (10YR

4/4), and strong brown (7.5YR 5/6); moderate fine and medium subangular blocky structure; firm; common thin discontinuous clay films of dark gray (5Y 4/1), gray (5Y 5/1), and very dark gray (5Y 3/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of dark yellowish brown (10YR 4/4), very dark gray (10YR 3/1), and strong brown (7.5YR 5/6); slightly acid; gradual smooth boundary.

B32t—36 to 46 inches; gray (5Y 5/1) silty clay loam; common fine faint mottles of olive gray (5Y 5/2), light olive gray (5Y 6/2), light gray (5Y 6/1), and dark gray (5Y 4/1); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); moderate medium subangular blocky structure; firm; few thin patchy clay films of dark gray (5Y 4/1), gray (5Y 5/1), and very dark gray (5Y 3/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and reddish brown (5YR 4/3); neutral; gradual smooth boundary.

C—46 to 60 inches; gray (5Y 6/1) silty clay loam; common fine faint mottles of gray (5Y 5/1), olive gray (5Y 6/2), and dark gray (5Y 4/1); common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); massive; friable; common fine and medium segregations and concretions (iron and manganese oxides) of very dark gray (10YR 3/1), strong brown (7.5YR 5/6), and reddish brown (5YR 4/3); neutral.

The solum ranges from 42 to 72 inches in thickness. The mollic epipedon ranges from 16 to 24 inches thick.

The Ap and A1 horizons are black (10YR 2/1 or N 2/0). They are 10 to 16 inches thick and are slightly acid, unless limed. The A3 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (2.5Y 3/2). It is medium acid or slightly acid. The B2t horizon is silty clay or silty clay loam. It is medium acid or slightly acid.

Tuskeego series

The soils of the Tuskeego series are poorly drained and very slowly permeable. They are on bottom land. The Tuskeego soils formed in silty and clayey alluvial sediments under a native vegetation of mixed prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Tuskeego soils are associated on the landscape with Koszta and Watkins soils and are similar to Humeston soils. Koszta and Watkins soils have less clay and higher chroma in the B horizon than Tuskeego soils. Humeston soils have a mollic epipedon.

Typical pedon of Tuskeego silt loam, 0 to 2 percent slopes, 1,300 feet north and 1,450 feet west of the southeast corner of section 34, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A21—8 to 14 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common fine faint mottles of dark grayish brown (10YR 4/2); moderate medium platy structure; friable; few silt coatings of gray (10YR 6/1) on peds; few fine segregations (iron oxides) of strong brown (7.5YR 5/6); strongly acid; gradual wavy boundary.

A22—14 to 18 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 6/1) dry; weak medium platy structure parting to weak medium subangular blocky; friable; few silt coatings of gray (10YR 6/1) on peds; few fine segregations (iron oxides) of strong brown (7.5YR 5/6); strongly acid; gradual wavy boundary.

B1—18 to 22 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 6/1) dry; common fine faint mottles of dark grayish brown (10YR 4/2) and brown (10YR 4/3); moderate fine and medium subangular blocky structure; firm; few thin discontinuous clay films of dark gray (10YR 4/1) on peds; few silt coatings of gray (10YR 6/1) on peds; few fine segregations (iron oxides) of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); strongly acid; clear wavy boundary.

B21t—22 to 32 inches; dark grayish brown (10YR 4/2) silty clay; common fine distinct mottles of brown (7.5YR 4/4) and strong brown (7.5YR 5/6); moderate medium prismatic structure parting to moderate fine angular and subangular blocky; very firm; common coatings of very dark gray (10YR 3/1) on peds; common thin discontinuous clay films of dark gray (10YR 4/1) on peds; few silt coatings of gray (10YR 6/1) on peds; few fine segregations (iron oxides) of brown (7.5YR 4/4) and strong brown (7.5YR 5/6); strongly acid; gradual smooth boundary.

B22t—32 to 45 inches; dark gray (10YR 4/1) silty clay; common fine distinct mottles of brown (7.5YR 4/4) and strong brown (7.5YR 5/6); moderate fine angular and subangular blocky structure; very firm; thin nearly continuous clay films of dark gray (10YR 4/1) on peds; few fine segregations (iron oxides) of brown (7.5YR 4/4) and strong brown (7.5YR 5/6); strongly acid; gradual smooth boundary.

B23t—45 to 49 inches; dark gray (10YR 4/1) silty clay; common fine distinct mottles of yellowish brown (10YR 5/6), brown (7.5YR 4/4), and strong brown (7.5YR 5/6); weak fine and medium subangular blocky structure; very firm; thin nearly continuous clay films of dark gray (10YR 4/1) on peds; few fine segregations (iron oxides) of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); medium acid; gradual wavy boundary.

B3—49 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct mottles of gray (10YR

(5/1), dark gray (10YR 4/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); weak fine and medium subangular blocky structure; firm; few fine segregations and concretions (iron and manganese oxides) of strong brown (7.5YR 5/6), brown (7.5YR 4/4), and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness.

The Ap or A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 7 to 9 inches thick and ranges from strongly acid to neutral. The A2 horizon is dark gray (10YR 4/1) or gray (10YR 5/1). It ranges from strongly acid to slightly acid. The B2t horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2). It is silty clay or silty clay loam and ranges from strongly acid to slightly acid.

Vesser series

The soils of the Vesser series are somewhat poorly drained or poorly drained and moderately permeable. They are on high bottom land, foot slopes, and alluvial fans. The Vesser soils formed in silty alluvium under a native vegetation of prairie grasses that tolerate wetness. Slopes range from 0 to 5 percent.

Vesser soils are associated on the landscape with Colo, Coppock, Humeston, and Nodaway soils. Colo soils do not have a B horizon and have a thicker mollic epipedon than Vesser soils. Coppock soils do not have a mollic epipedon. Humeston soils have more clay in the B horizon. Nodaway soils have less clay in the control section and do not have a B horizon.

Typical pedon of Vesser silt loam, 0 to 2 percent slopes, 420 feet south and 1,260 feet east of the northwest corner of section 27, T. 73 N., R. 13 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine and fine granular structure; friable; neutral; clear smooth boundary.

A12—9 to 15 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; common fine faint mottles of very dark grayish brown (10YR 3/2); weak fine and medium subangular blocky structure parting to moderate fine and medium granular; friable; few fine segregations (iron oxides) of strong brown (7.5YR 5/6 & 5/8); slightly acid; gradual smooth boundary.

A21—15 to 24 inches; dark gray (10YR 4/1) silt loam; common fine faint mottles of gray (10YR 5/1) and grayish brown (10YR 5/2); weak thin and medium platy structure; friable; common coatings of very dark gray (10YR 3/1) on peds; few fine segregations (iron oxides) of strong brown (7.5YR 5/6 & 5/8); medium acid; gradual smooth boundary.

A22—24 to 30 inches; dark gray (10YR 4/1) silt loam; common fine faint mottles of gray (10YR 5/1) and grayish brown (10YR 5/2); weak fine and medium subangular blocky structure; friable; common fine segregations (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B1tg—30 to 38 inches; gray (10YR 5/1) silty clay loam; common fine faint mottles of dark gray (10YR 4/1), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; friable; thin nearly continuous clay films of dark gray (10YR 4/1) and gray (10YR 5/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B21tg—38 to 48 inches; grayish brown (10YR 5/2) silty clay loam; common fine faint mottles of gray (10YR 5/1) and yellowish brown (10YR 5/6); moderate fine and medium subangular blocky structure; firm; thin nearly continuous clay films of gray (10YR 5/1) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); medium acid; gradual smooth boundary.

B22tg—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint mottles of gray (10YR 5/1) and yellowish brown (10YR 5/6); moderate medium subangular blocky structure; firm; thin nearly continuous clay films of grayish brown (10YR 5/2) on peds; common fine and medium segregations and concretions (iron and manganese oxides) of brown (7.5YR 4/4), strong brown (7.5YR 5/6 & 5/8), and very dark gray (10YR 3/1); slightly acid.

The solum ranges from 48 to 72 inches in thickness. The mollic epipedon ranges from 12 to 20 inches thick.

The Ap or A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is silt loam or silty clay loam. The Ap and A1 horizons are 12 to 20 inches thick and are medium acid or slightly acid, unless limed. The A2 horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). It is strongly acid or medium acid. The B2t horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2). It ranges from strongly acid to slightly acid.

Waukee series

The soils of the Waukee series are well drained. They are on low stream terraces. These soils have a moderately permeable subsoil and a very rapidly permeable substratum. The Waukee soils formed in stratified loamy alluvium underlain by sand and gravel, under a native vegetation of tall grasses. Slopes range from 0 to 2 percent.

Waukee soils are associated on the landscape with Hoopeston and Sparta soils. Hoopeston soils contain more sand in the control section and have lower chroma in the B horizon than Waukee soils. Sparta soils contain more sand in the control section.

Typical pedon of Waukee loam, 0 to 2 percent slopes, 570 feet south and 580 feet west of the northeast corner of section 32, T. 71 N., R. 12 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; neutral; clear smooth boundary.

A12—10 to 14 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure parting to moderate medium granular; friable; medium acid; gradual smooth boundary.

A13—14 to 18 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; common fine faint mottles of dark brown (10YR 3/3); moderate very fine and fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21—18 to 26 inches; brown (10YR 4/3) loam; common fine faint mottles of dark yellowish brown (10YR 4/4); moderate fine subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

B22—26 to 31 inches; yellowish brown (10YR 5/4) loam; common fine faint mottles of dark yellowish brown (10YR 4/4) and brown (10YR 4/3); moderate fine and medium subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

B3—31 to 38 inches; yellowish brown (10YR 5/4) loam; common fine faint mottles of yellowish brown (10YR 5/6); weak medium subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) and brown (10YR 4/3) on peds; medium acid; gradual smooth boundary.

IIC1—38 to 54 inches; brown (7.5YR 4/4) loamy coarse sand; single grain; loose; medium acid; clear wavy boundary.

IIC2—54 to 60 inches; yellowish brown (10YR 5/6) gravelly sand; common fine distinct mottles of brown (7.5YR 4/4); single grain; loose; slightly acid.

The solum ranges from 30 to 48 inches. Loamy sand or gravelly sand is at a depth of 30 to 40 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 12 to 18 inches thick and ranges from strongly acid to slightly acid, unless limed. The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). It is loam or sandy clay loam and is strongly acid or medium acid. The IIC horizon ranges from brown (10YR 5/3) to strong brown (7.5YR 5/8). It is coarse loamy sand or gravelly sand that is more than 10 percent gravel.

Weller series

The soils of the Weller series are moderately well drained and slowly permeable. These soils are on convex side slopes and convex ridgetops in the loess-covered uplands and are on high stream terraces. The Weller soils formed in leached loess under a native vegetation of deciduous trees. Slopes range from 2 to 14 percent.

Weller soils are associated on the landscape with Beckwith and Pershing soils and are similar to Grundy soils. Beckwith soils have lower chroma in the Bt horizon than Weller soils. Pershing soils have a darker Ap horizon or thicker dark A1 horizon. Grundy soils have a mollic epipedon and do not have an A2 horizon.

Typical pedon of Weller silt loam, 2 to 5 percent slopes, 980 feet north and 1,970 feet west of the southeast corner of section 25, T. 71 N., R. 15 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A21—7 to 10 inches; yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate thin platy structure; friable; strongly acid; clear smooth boundary.

A22—10 to 16 inches; yellowish brown (10YR 5/4) silt loam, light gray (10YR 7/2) dry; strong very fine and fine subangular blocky structure; friable; common thin discontinuous clay films of dark grayish brown (10YR 4/2); common silt coatings of grayish brown (10YR 5/2) on peds; very strongly acid; clear smooth boundary.

B21t—16 to 20 inches; brown (10YR 5/3) silty clay; few fine ditinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); moderate very fine and fine subangular blocky structure; very firm; common thin discontinuous clay films of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) on peds; few very fine and fine segregations and concretions (oxides) of strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and black (10YR 2/1); very strongly acid; gradual smooth boundary.

B22t—20 to 26 inches; brown (10YR 5/3) silty clay; common fine distinct mottles of yellowish brown (10YR 5/6), brown (7.5YR 4/4), and strong brown (7.5YR 5/6); moderate fine and medium subangular blocky structure; very firm; common thin discontinuous clay films of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) on peds; common very fine and fine segregations and concretions (iron and manganese oxides) of black (10YR 2/1), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); very strongly acid; gradual smooth boundary.

B23t—26 to 36 inches; brown (10YR 5/3) silty clay; common fine distinct mottles of yellowish brown

(10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak fine and medium subangular blocky structure; very firm; common thin discontinuous clay films of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of black (10YR 2/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); very strongly acid; gradual smooth boundary.

B31t—36 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 4/4); weak fine and medium subangular blocky structure; firm; few thin patchy clay films of dark grayish brown (2.5Y 4/2); common fine segregations and concretions (iron and manganese oxides) of black (10YR 2/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); strongly acid; gradual smooth boundary.

B32t—44 to 52 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct mottles of brown (7.5YR 4/4), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6); weak medium subangular blocky structure; firm; few thin patchy clay films of dark grayish brown (2.5Y 4/2) on peds; common fine segregations and concretions (iron and manganese oxides) of black (10YR 2/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid; gradual smooth boundary.

C—52 to 64 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), brown (7.5YR 4/4), and light brownish gray (2.5Y 6/2); very weak medium subangular blocky structure; friable; common fine segregations and concretions (iron and manganese oxides) of black (10YR 2/1), strong brown (7.5YR 5/6), and dark brown (7.5YR 3/2); medium acid.

The solum ranges from 48 to 72 inches or more in thickness.

The A1 horizon, if there is one, ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It is 0 to 5 inches thick and is strongly acid or medium acid. The Ap horizon, if there is one, is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). It is silt loam or silty clay loam and is strongly acid or medium acid, unless limed. The A2 horizon, if there is one, is grayish brown (10YR 5/2) or brown (10YR 5/3), but if mixed with the B horizon, it will include yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4). It ranges from very strongly acid to medium acid. The B2t horizon is yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4). It is silty clay or silty clay loam and ranges from very strongly acid to medium acid.

Wiota series

The soils of the Wiota series are well drained or moderately well drained and moderately permeable. They are on low stream terraces. The Wiota soils formed in silty alluvium under a native vegetation of prairie grasses. Slopes range from 1 to 3 percent.

Wiota soils are associated on the landscape with Nevin and Richwood soils. Nevin soils have lower chroma in the Bt horizon than Wiota soils. Richwood soils have less clay in the B horizon.

Typical pedon of Wiota silt loam, 1 to 3 percent slopes, 2,040 feet south and 80 feet west of the northeast corner of section 29, T. 71 N., R. 12 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; friable; neutral; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A3—14 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; common coatings of very dark brown (10YR 2/2) on peds; slightly acid; gradual smooth boundary.

B21t—20 to 25 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; common coatings of very dark grayish brown (10YR 3/2) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) on peds; slightly acid; gradual smooth boundary.

B22t—25 to 30 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; common coatings of dark brown (10YR 3/3) on peds; common thin discontinuous clay films of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) on peds; slightly acid; gradual smooth boundary.

B23t—30 to 39 inches; brown (10YR 4/3) silty clay loam; moderate fine and medium subangular blocky structure; friable; common thin discontinuous clay films of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

B3—39 to 50 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; few thin patchy clay films of dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) on peds; medium acid; gradual smooth boundary.

C—50 to 72 inches; brown (10YR 4/3) silt loam; massive; friable; medium acid.

The solum is typically more than 40 inches thick and ranges from 36 to 60 inches. The mollic epipedon ranges from 18 to 30 inches thick.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 18 to 30 inches thick and is medium acid or slightly acid, unless limed. The B2t horizon is brown (10YR 4/3), dark brown (10YR 3/3), and dark yellowish brown (10YR 4/4). The C horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4). It is silt loam or silty clay loam.

Zook series

The soils of the Zook series are poorly drained and slowly permeable. They are on bottom land. The Zook soils formed in fine-textured alluvium under a native vegetation of swamp grasses, sedges, and prairie grasses that tolerate wetness. Slopes range from 0 to 2 percent.

Zook soils are associated on the landscape with Colo and Humeston soils. Colo soils have less clay in the control section than Zook soils. Humeston soils have a thinner mollic epipedon and have an A2 horizon.

Typical pedon of Zook silty clay loam, 0 to 2 percent slopes, 1,440 feet south and 30 feet west of the northeast corner of section 20, T. 73 N., R. 13 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 18 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; common fine faint mottles of very dark gray (10YR 3/1); moderate very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A13—18 to 24 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; few fine faint mottles of very dark gray (10YR 3/1); moderate very fine and fine subangular blocky structure; firm; neutral; gradual smooth boundary.

A3—24 to 35 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; few fine faint mottles of very dark gray (10YR 3/1); moderate fine subangular blocky structure; firm; neutral; gradual smooth boundary.

Bg—35 to 48 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; common fine faint mottles of very dark gray (10YR 3/1); moderate fine and medium subangular blocky structure; firm; neutral; gradual smooth boundary.

Cg—48 to 62 inches; dark gray (5Y 4/1) silty clay; common fine faint mottles of very dark gray (5Y 3/1), gray (5Y 5/1), and light olive brown (2.5Y 5/4); massive; firm; neutral.

The solum ranges from 36 to 64 inches in thickness. The mollic epipedon ranges from 36 to 50 inches thick.

The Ap and A1 horizons are 16 to 24 inches thick and range from medium acid to neutral. The B horizon ranges from black (10YR 2/1) to gray (5Y 5/1). The black (10YR 2/1) and very dark gray (10YR 3/1) colors extend to the depth of 36 to 50 inches. The B horizon is silty clay or silty clay loam and ranges from medium acid to neutral.

formation of the soils

This section discusses the factors of soil formation and relates these factors to the soils in Wapello County.

factors of soil formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical compositon of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material (*5*).

Climate and vegetation are the active factors in the formation of soil. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. It may be much or little, but some time is always required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material and geology

Most of the soils in Wapello County formed in glacial till, or ice-laid material; loess, or windblown material; and alluvium, or water-laid material. A few small areas of eolian sands are along the Des Moines River, and in some places shale is the parent material. In this county parent material is important in developing the general character of the soil profile.

Glacial till.—In Wapello County the major Pleistocene deposits of pre-Wisconsin age are Nebraskan and Kansan glacial till (*16*). The Kansan till is identifiable throughout the county, and on side slopes it forms an extensive part of the landscape. The Nebraskan till, however, is not readily identifiable on the surface.

In some of the deep road cuts and along some of the major stream valleys, a gumbotil is present below the Kansan glacial till. This is called Aftonian gumbotil (*6, 7*). It consists mainly of glacial till made up of coarse fragments in a clay loam matrix. The upper part of this till consists of yellowish-brown material that is oxidized and leached. Below this zone is dark gray material that is calcareous, contains limestone and dolomite particles, and is neither oxidized nor leached.

Soils formed on the Kansan till plain during the Yarmouth and Sangamon interglacial stages, before the loess was deposited. On nearly level interstream divides, the soils were strongly weathered and had a gray plastic subsoil which was a Paleosol. This Paleosol remains; it is several feet thick and is very slowly permeable. The Ashgrove, Clarinda, and Rinda soils formed in this Paleosol and are extensive throughout the county. Geologic erosion has cut below the Yarmouth-Sangamon paleosol and into the Kansan till and older deposits. At the depth to which this erosion has cut, generally there is a stone line or subjacent till that is overlain by pedisediment (*11, 14*). A paleosol formed in the pedisediment and in the subjacent till. The Adair, Armstrong, and Keswick soils formed in this material.

Geologic erosion removed the loess from many slopes and exposed strongly eroded, weathered paleosols. In some places the paleosols have been beveled or truncated, and only the lower part of the strongly weathered materials remains. In other places erosion removed all of the paleosols and exposed till that is only slightly weathered. The period during which erosion cut through and below the Yarmouth-Sangamon paleosol is called Late Sangamon (*11, 12*). The material below the paleosols consists of loamy sediments over a stone line that, in turn, is over a highly weathered, clayey, reddish-brown, acid till. Material that formed in the Late Sangamon stage is exposed on the narrow, slightly lower interstream divides and on some side slopes.

Adair, Armstrong, and Keswick soils formed in this Late Sangamon material. Caleb, Douds, Galland, and Mystic soils formed in Pre-Late Sangamon sediments of valley fills. These alluvial sediments are of glacial origin, and they have variable texture. Caleb, Douds, Galland, and Mystic soils are on low, stepped interfluves above the present drainage system. Their landscape is partly valley fill, but their surface merges with the present erosional uplands. Caleb, Douds, Galland, and Mystic soils are in distinctly higher landscape positions than the soils on the flood plain, but they are in lower positions than Gara, Shelby, and Lindley soils that formed on dissected slopes of Late Wisconsin age. These Pre-Late Sangamon erosional sediments appear to have been angularly truncated in many places. As a result, they generally consist of an irregular mixture of materials that have contrasting textures.

Loess.—Wisconsin-age loess covers most of Wapello County and is an extensive parent material (*13*). It consists of accumulated particles of silt and clay that have been deposited by wind. Variations in soils are related to the distance of the soils from the source of loess, which is probably the Missouri River bottom in the western part of Iowa (*3*).

On the stable upland divides, the loess is about 8 to 10 feet thick. It is slightly thicker in the northern part of the county, where Mahaska, Otley, and Taintor soils are the dominant loessial soils, than it is in the southern part, where the Grundy and Haig soils are the dominant loessial soils. Arispe, Beckwith, Belinda, Clinton, Edina, Givin, Kalona, Ladoga, Nira, Pershing, Sperry, and Weller soils also were derived from loess. Many of the high benches along the Des Moines River are covered with loess. The loess on these benches contain slightly less clay and slightly more sand than the loess that covers the uplands. The soil material underlying the loess in these areas is stratified alluvium that is high in sand and gravel.

Alluvium.—Sediments that have been removed and laid down by water are called alluvium. As they move, these sediments are sorted to some extent, but they are as well sorted as loess in only a few places. Also, alluvium does not have the wide range of particle sizes that occurs in glacial drift. Because the alluvium in Wapello County is derived from loess and glacial drift, it is largely a mixture of silt and clay, of silt and sand, or of sand and gravel. The coarse sand and gravel generally are only in the pre-Sangamon alluvial sediments on the stream benches. Sediments accumulated at the foot of the slope on which they originated are called colluvium, or local alluvium.

Alluvial sediments are the parent materials of the soils on flood plains or terraces and along drainageways. As the river overflows its channels and the water spreads over the flood plains, coarse-textured materials such as the sand and coarse silt are deposited first. As the floodwater continues to spread, it moves more slowly, and finer-textured sediments are deposited. After the flood has passed, the finest particles, or clay, settle from the water that is left standing on the lowest part of the flood plain.

Landes, Nodaway, and Perks soils commonly are closest to the stream channel and are coarser textured than the other soils on the bottom land. Colo, Coppock, Nevin, Richwood, Wiota, and Zook soils are fairly extensive along the Des Moines River where they are generally away from the meanders of the stream. Colo, Humeston, and Tuskeego soils are along the smaller streams in the county. Zook soils commonly are on the lower part of the bottom land and are the finest textured soils derived from alluvium in the county. Colo and Coppock soils are widely distributed throughout the county. In some places they formed in local alluvium at the base of upland slopes. Cantril soils are the dominant soils that formed in local colluvium or alluvium in the county, and they commonly contain more sand than the other soils that formed in alluvium.

In some areas streams are still cutting through shale, and flood plains are narrower and have a steeper gradient. The Nodaway-Cantril complex and the Nodaway soils are on these flood plains.

Shale.—The oldest parent material in the county is a series of beds deposited during the Des Moines sedimentary cycle in the Pennsylvanian period. These beds consist of shale of different colors and textures, conglomerate, and a few organic layers such as coal. There is a very wide range in thickness of these layers, or beds.

There is a wide range of texture, reaction, and other characteristics in the profiles of soils formed in shale in southern Iowa. The shale ranges from nearly black to red, but red, brown, and grayish colors are dominant. Thin beds of sandstone and coal are between layers of shale in places. The Gosport soils formed in brownish and grayish shales.

climate

The soils in Wapello County have been forming under a midcontinental, subhumid climate for the past 5,000 years (*13*). The morphology and properties of most of the soils in this period indicate that the climate was similar to the present climate. From 6,500 to 16,000 years ago, however, the climate probably was cool and moist and was conducive mostly to growth of forest vegetation. Lane's pollen study (*8*) indicates that the climate during the Sangamon interglacial stage of the Pleistocene Epoch was cool and moist and conducive mostly to the growth of conifers.

The influence of the general climate in a region is modified by local conditions in or near the developing soils. For example, soils on south-facing slopes formed under a microclimate that was warmer and drier than the average climate of nearby areas. The low-lying, poorly drained soils on bottom land formed under a wetter and colder climate than that in most areas around them. These differences influence the characteristics of the soil and account for some of their differences in the same general climatic region.

vegetation

Many changes in climate and vegetation took place in Iowa during the postglacial period. Spruce grew on the soils from 12,000 to 8,000 years ago and was followed by coniferous-deciduous forest that lasted until about 6,500 years ago. Then grass began to dominate.

For the past 5,000 years, the soils of Wapello County appear to have been influenced by two main kinds of vegetation—prairie grasses and trees. Big bluestem and little bluestem were the main prairie grasses. The main trees were deciduous—mainly oak, hickory, ash, elm, and maple.

The effects of vegetation on soils similar to those in Wapello County have been studied recently. Evidence shows that vegetation shifted while soils formed in areas bordering trees and grasses. The morphology of Armstrong, Belinda, Caleb, Gara, Givin, Hedrick, Ladoga, Mystic, Pershing, and Rinda soils reflects the influence of both trees and grasses. The Ashgrove, Keswick, Lindley, and Weller soils formed under trees (*10*). Grasses influenced the formation of Adair, Arispe, Clarinda, Colo, Edina, Grundy, Haig, Kalona, Mahaska, Nira, Otley, Shelby, Sperry, Taintor, and Zook soils.

Soils that formed under trees are lighter colored, are more acid, and have a thinner surface layer than soils that formed under grasses. The few soils in the county that formed under shifting vegetation, or mixed grasses and trees, have properties that are intermediate between the properties of soils that formed under grasses and those of soils that formed under trees.

relief

Relief is an important cause of differences among soils. It indirectly influences soil formation through its effect on drainage. In Wapello County soils range from level to very steep. In many areas of the bottom land the nearly level soils are frequently flooded and have a permanently or periodically high water table. In depressions, water soaks into the nearly level soils that are subject to flooding. Much of the rainfall runs off the steep soils.

Level soils are on the broad upland flats and on the stream bottoms. The steepest soils in the county are generally on the southern and western sides of the major streams and their tributaries. The intricate pattern of upland drainageways indicates that in nearly all of the county the landscape has been modified by geological processes.

Generally, the Belinda, Edina, Haig, Taintor, and Zook soils that formed where the water table is high have a subsoil that is dominantly grayish. Adair, Grundy, Mahaska, Pershing, and similar soils formed where the water table fluctuated and was periodically high. Gara, Lindley, and other soils formed where the water table was below the subsoil, and their subsoil is yellowish brown. Colo, Haig, Taintor, and Zook soils, which developed under prairie grasses and have a high water table, contain more organic matter in the surface layer than well drained soils that formed under prairie grasses. Clay accumulates in the subsoil of the Edina soils, which are slightly depressional or nearly level, because a large amount of water enters and carries clay particles downward. Edina soils are commonly called claypan soils because of their very slowly permeable subsoil in which the greatest amount of clay accumulates.

A study of Pershing and Weller soils was made to determine the effect of relief. Tests showed that from the stable to the unstable slopes there was an increase in content of clay in the A horizon and a decrease in thickness of the A1 horizon. In the unstable landscape the zone of maximum clay accumulation was at a shallow depth. This indicates that more soil development has taken place on the most stable kind of landscape.

In Gara, Lindley, Shelby, and similar soils that have a wide range in slope and many kinds of slopes, depth to carbonates is shallowest where slopes are steepest, convex, or most unstable.

time

The length of time required for a soil to form affects the kind of soil that forms. An older or more strongly developed soil shows well-defined genetic horizons. A less well-developed soil shows no horizons, or only weakly defined ones. Most soils on the flood plains are weakly developed because they have not been in place long enough for distinct horizons to develop.

On the steeper soils, material is generally removed before there has been time to develop a thick profile that has strong horizons. Even though the material has been in place for a long time, the soil may still be immature because much of the water runs off the slopes rather than through the soil material. Ruhe (*12*) stated that Shelby, Gara, and Lindley soils formed on recently dissected slopes of late Wisconsin age. These soils, therefore, are no older than 11,000 to 14,000 years and probably are much younger.

According to Ruhe and Scholtes (*15*), Adair, Armstrong, Keswick, Clarinda, and Mystic soils are among the oldest in the county. Clarinda soils formed in Kansan glacial till during the Yarmouth-Sangamon period. Adair, Armstrong, Kewsick, and Mystic soils formed from materials deposited during the late Sangamon interglacial stage. These materials are much older than the loessial parent material of Arispe, Beckwith, Belinda, Edina, Haig, Givin, Grundy, Kalona, Ladoga, Mahaska, Nira, Otley, Pershing, Sperry, Taintor, and Weller soils. These soils are no older than 14,000 to 16,000 years, and they may be considerably younger.

Radiocarbon studies of wood fragments and organic matter found in the loess and glacial till have made it possible to determine the approximate ages of soils and of the loessial and glacial deposits in Iowa. In Wapello County the loess is thickest in the nearly level soils on stable upland divides, and it is underlain by a Yarmouth-Sangamon paleosol that is on the Kansan till or till-derived sediments. In many places below the stable uplands, there is an organic layer at the base of the loess. Ruhe and others recently studied the loess and organic matter below the solum of the Edina and Haig soils in Wayne County, Iowa, and obtained radiocarbon ages of 19,000 to 20,000 years. The Kansan till surface is 8 feet below the present land surface.

man's influence on the soil

Important changes take place in the soil when it is cultivated. Some of these changes have little effect on productivity; other have a drastic effect.

Changes caused by water erosion generally are the most apparent. On many of the cultivated soils in the county, particularly the gently rolling to hilly ones, part or all of the original surface layer has been lost through sheet erosion. In some places shallow to deep gullies have formed.

In many continuously cultivated fields, the granular structure that was apparent when the grassland was undisturbed is no longer present. In these fields the surface tends to bake and harden when it dries. Fine-textured soils that have been plowed when too wet tend to puddle and are less permeable than similar soils in undisturbed areas.

Man has done much to increase productivity of the soils and to reclaim areas not suitable for crops. He has made large areas of bottom land suitable for cultivation by digging drainage ditches and constructing diversions at the foot of slopes. Broad flats consisting of Haig and Taintor soils have been greatly improved for cultivation by installing some kind of drainage system.

By adding commercial fertilizers, man has counteracted deficiencies in plant nutrients and has made some soils more productive than they were in their natural state.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69 *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Hutton, Curtis E. 1947. Studies of loess-derived soils in southwestern Iowa. Soil Sci. Soc. Am. Proc. 12: 424-431, illus.

(4) Iowa crop and livestock reporting service. 1977. Agriculture statistics.

(5) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(6) Kay, George F. 1916. Gumbotil: A new term in pleistocene geology. Sci. 44: 637-638.

(7) Kay, George F. and Earl T. Apfel. 1929. The Pre-Illinoian pleistocene geology of Iowa. Iowa Geol. Surv. Ann. Rpt. 34. 304 pp., illus.

(8) Lane, G. H. 1941. Pollen analysis of interglacial peats of Iowa. Iowa Geol. Surv. Ann. Rep. 37: 237-260, illus.

(9) Munsell, Harry B. and Glenn B. Meager. 1923. Ottumwa—Yesterday and Today. Harry B. Munsell and Glenn B. Meager.

(10) Prill, R. C. and F. F. Reicken. 1958. Variations in forest derived soils formed in Kansan till in southern and southeastern Iowa. Soil Sci. Soc. Am. Proc. 22: 70-75, illus.

(11) Ruhe, Robert V. 1956. Geomorphic surfaces and the nature of soils. Soil Sci. 82: 441-445, illus.

(12) Ruhe, Robert V. 1959. Stone lines in soils. Soil Sci. 87: 223-231, illus.

(13) Ruhe, Robert V., Meyer Rubin, and W. H. Scholtes. 1957. Late pleistocene radiocarbon chronology in Iowa. Am. J. Sci. 225. 671-689.

(14) Ruhe, Robert V. and R. B. Daniels. 1958. Soils, paleosols, and soil-horizon nomenclature. Soil Sci. Soc. Am. Proc. 22: 66-69, illus.

(15) Ruhe, Robert V. and W. H. Scholtes. 1955. Radiocarbon dates in central Iowa. J. Geol. 63: 82-92, illus.

(16) Scholtes, W. H., Robert V. Ruhe, and F. F. Reicken. 1951. Use of morphology of buried soil profiles in the pleistocene of Iowa. Iowa Acad. Sci. Proc. 58: 295-306.

(17) United States Department of Agriculture. 1917. Soil survey of Wapello County. 43 pp.

(18) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric Handb. 18, 502 pp., illus. [Supplement replacing pp. 173-188 issued May 1962]

(19) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(20) Waterman, Harrison L. 1914. History of Wapello County. Vol. I.

glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gumbotil. Leached, deoxidized clay containing siliceous stones; the produce of thorough chemical decomposition of clay-rich glacial till.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Paleosol. A buried soil or formerly buried soil, especially one that formed during an interglacial period and was covered by deposits of later glaciers.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. Water-sorted sediment at the top of a paleosol or glacial till.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables air and water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	^{o} F	^{o} F	^{o} F	^{o} F	^{o} F	Units	In	In	In		In
January----	29.3	12.0	20.6	59	-19	0	1.22	0.49	1.81	3	7.5
February---	35.4	17.8	26.6	63	-14	0	.96	.42	1.39	3	5.4
March------	45.1	26.8	36.0	78	0	35	2.34	1.02	3.41	6	6.1
April------	61.3	40.7	51.0	86	22	109	3.53	1.94	4.82	7	.6
May--------	72.7	51.9	62.3	91	32	389	4.00	2.24	5.44	7	.0
June-------	82.0	61.6	71.8	97	46	654	3.81	2.36	5.11	7	.0
July-------	85.9	65.9	75.9	100	52	803	4.54	2.55	6.15	7	.0
August-----	84.0	63.6	73.8	99	50	738	3.66	1.50	5.40	6	.0
September--	75.9	54.8	65.4	94	36	462	3.71	1.52	5.47	6	.0
October----	65.7	44.4	55.0	88	24	217	2.42	.72	3.77	5	.2
November---	48.4	30.5	39.5	74	6	13	1.68	.56	2.57	3	1.9
December---	34.8	19.1	27.0	63	-11	0	1.34	.59	1.94	4	5.8
Year-----	60.0	40.8	50.4	101	-19	3,420	33.21	26.85	39.23	64	27.5

[1]Recorded in the period 1951-74 at Ottumwa, Iowa

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50^{o} F.)

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 12	April 23	May 2
2 years in 10 later than--	April 8	April 19	April 28
5 years in 10 later than--	April 1	April 10	April 20
First freezing temperature in fall:			
1 year in 10 earlier than--	October 21	October 14	October 4
2 years in 10 earlier than--	October 26	October 19	October 9
5 years in 10 earlier than--	November 4	October 29	October 18

[1]Recorded in the period 1951-74 at Ottumwa, Iowa

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	195	182	161
8 years in 10	202	188	168
5 years in 10	217	200	180
2 years in 10	231	213	191
1 year in 10	239	219	198

[1]Recorded in the period 1951-74 at Ottumwa, Iowa

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
7	Wiota silt loam, 1 to 3 percent slopes	280	0.1
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes	8,280	3.0
13B	Humeston-Vesser-Colo complex, 2 to 5 percent slopes	1,220	0.4
23C	Arispe silty clay loam, 5 to 9 percent slopes	510	0.2
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded	2,380	0.9
41B	Sparta loamy fine sand, 1 to 4 percent slopes	280	0.1
41C	Sparta loamy fine sand, 4 to 10 percent slopes	300	0.1
41E	Sparta loamy fine sand, 10 to 20 percent slopes	170	0.1
51	Vesser silt loam, 0 to 2 percent slopes	250	0.1
54	Zook silty clay loam, 0 to 2 percent slopes	2,210	0.8
56B	Cantril loam, 2 to 5 percent slopes	710	0.3
58D2	Douds loam, 9 to 14 percent slopes, moderately eroded	380	0.1
58E	Douds loam, 14 to 18 percent slopes	400	0.1
58E2	Douds loam, 14 to 18 percent slopes, moderately eroded	650	0.2
58G	Douds soils, 18 to 40 percent slopes	380	0.1
65E	Lindley loam, 14 to 18 percent slopes	760	0.3
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	2,040	0.7
65F	Lindley loam, 18 to 25 percent slopes	13,350	4.9
65G	Lindley loam, 25 to 40 percent slopes	4,340	1.6
75B	Givin silt loam, 2 to 5 percent slopes	460	0.2
76B	Ladoga silt loam, 2 to 5 percent slopes	690	0.2
76C	Ladoga silt loam, 5 to 9 percent slopes	480	0.2
80B	Clinton silt loam, 2 to 5 percent slopes	380	0.1
80C	Clinton silt loam, 5 to 9 percent slopes	1,830	0.7
80C2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	3,510	1.3
80D2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	2,470	0.9
88	Nevin silty clay loam, 0 to 2 percent slopes	2,150	0.8
93D2	Shelby-Adair clay loams, 9 to 14 percent slopes, moderately eroded	480	0.2
122	Sperry silt loam, 0 to 1 percent slopes	260	0.1
130	Belinda silt loam, 0 to 2 percent slopes	690	0.2
131B	Pershing silt loam, 2 to 5 percent slopes	4,560	1.6
131C	Pershing silt loam, 5 to 9 percent slopes	560	0.2
132B	Weller silt loam, 2 to 5 percent slopes	1,870	0.7
132C	Weller silt loam, 5 to 9 percent slopes	1,970	0.7
133	Colo silty clay loam, 0 to 2 percent slopes	3,800	1.4
133+	Colo silt loam, overwash, 0 to 2 percent slopes	1,020	0.4
173	Hoopeston fine sandy loam, 1 to 3 percent slopes	380	0.1
178	Waukee loam, 0 to 2 percent slopes	330	0.1
179E	Gara loam, 14 to 18 percent slopes	350	0.1
179E2	Gara loam, 14 to 18 percent slopes, moderately eroded	2,300	0.8
179F	Gara loam, 18 to 25 percent slopes	1,670	0.6
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	690	0.2
192D	Adair silty clay loam, 9 to 14 percent slopes	300	0.1
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	920	0.3
208	Landes fine sandy loam, 1 to 3 percent slopes	430	0.2
211	Edina silt loam, 0 to 1 percent slopes	970	0.3
220	Nodaway silt loam, 0 to 2 percent slopes	4,920	1.8
222C	Clarinda silty clay loam, 5 to 9 percent slopes	870	0.3
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	1,640	0.6
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded	4,950	1.8
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded	870	0.3
230C	Arispe-Clearfield silty clay loams, 5 to 9 percent slopes	1,390	0.5
260	Beckwith silt loam, 0 to 2 percent slopes	380	0.1
269	Humeston silt loam, 0 to 2 percent slopes	2,180	0.8
276C2	Ladoga-Hedrick silt loams, 5 to 9 percent slopes, moderately eroded	3,850	1.4
279	Taintor silty clay loam, 0 to 2 percent slopes	8,070	2.9
280	Mahaska silty clay loam, 0 to 2 percent slopes	6,900	2.5
280B	Mahaska silty clay loam, 2 to 5 percent slopes	2,470	0.9
281B	Otley silty clay loam, 2 to 5 percent slopes	6,410	2.3
281C	Otley silty clay loam, 5 to 9 percent slopes	4,320	1.5
313E	Gosport silt loam, 9 to 18 percent slopes	1,650	0.6
313E2	Gosport silt loam, 9 to 18 percent slopes, moderately eroded	3,290	1.2
313F	Gosport silt loam, 18 to 40 percent slopes	6,390	2.3
315	Landes-Perks-Nodaway complex, 1 to 3 percent slopes	810	0.3
362	Haig silt loam, 0 to 2 percent slopes	9,460	3.4
363	Haig silty clay loam, 0 to 2 percent slopes	550	0.2
364B	Grundy silt loam, 2 to 5 percent slopes	8,600	3.1
380B	Mahaska silt loam, 2 to 5 percent slopes	1,030	0.4
424D2	Lindley-Keswick loams, 9 to 14 percent slopes, moderately eroded	2,100	0.8
424E	Lindley-Keswick loams, 14 to 18 percent slopes	1,230	0.4
424E2	Lindley-Keswick loams, 14 to 18 percent slopes, moderately eroded	3,510	1.3
425D	Keswick loam, 9 to 14 percent slopes	2,450	0.9

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
425D2	Keswick loam, 9 to 14 percent slopes, moderately eroded	7,350	2.6
451D2	Caleb loam, 7 to 14 percent slopes, moderately eroded	600	0.2
453	Tuskeego silt loam, 0 to 2 percent slopes	2,020	0.7
478G	Gosport-Rock outcrop complex, 25 to 40 percent slopes	280	0.1
520	Coppock silt loam, 0 to 2 percent slopes	2,000	0.7
570C	Nira silty clay loam, 5 to 9 percent slopes	1,400	0.5
581C2	Otley-Nira silty clay loams, 5 to 9 percent slopes, moderately eroded	5,670	2.0
592C2	Mystic silt loam, 5 to 9 percent slopes, moderately eroded	640	0.2
592D2	Mystic silt loam, 9 to 14 percent slopes, moderately eroded	1,250	0.4
594C2	Galland loam, 5 to 9 percent slopes, moderately eroded	590	0.2
594D2	Galland loam, 9 to 14 percent slopes, moderately eroded	4,050	1.4
594E2	Galland loam, 14 to 18 percent slopes, moderately eroded	1,890	0.7
688	Koszta silt loam, 0 to 2 percent slopes	820	0.3
715	Nodaway-Landes complex, 0 to 2 percent slopes	2,540	0.9
730B	Nodaway-Cantril complex, 2 to 5 percent slopes	12,000	4.3
731C2	Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded	12,050	4.3
732C2	Weller silty clay loam, 5 to 9 percent slopes, moderately eroded	14,210	5.2
732D2	Weller silty clay loam, 9 to 14 percent slopes, moderately eroded	4,100	1.5
779	Kalona silty clay loam, 0 to 1 percent slopes	630	0.2
792C2	Armstrong loam, 5 to 9 percent slopes, moderately eroded	310	0.1
792D	Armstrong loam, 9 to 14 percent slopes	630	0.2
792D2	Armstrong loam, 9 to 14 percent slopes, moderately eroded	8,120	2.9
795D2	Ashgrove silty clay loam, 9 to 14 percent slopes, moderately eroded	570	0.2
831C2	Pershing silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	1,450	0.5
832C2	Weller silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	1,620	0.6
876B	Ladoga silt loam, benches, 2 to 5 percent slopes	890	0.3
876C	Ladoga silt loam, benches, 5 to 9 percent slopes	470	0.2
876C2	Ladoga silt loam, benches, 5 to 9 percent slopes, moderately eroded	1,570	0.6
880B	Clinton silt loam, benches, 2 to 5 percent slopes	450	0.2
880C	Clinton silt loam, benches, 5 to 9 percent slopes	690	0.2
880C2	Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded	2,360	0.8
881B	Otley silty clay loam, benches, 2 to 5 percent slopes	660	0.2
881C2	Otley silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	970	0.3
892D2	Mystic Variant, silty clay loam, 7 to 12 percent slopes, moderately eroded	380	0.1
977	Richwood silt loam, 0 to 2 percent slopes	1,720	0.6
977B	Richwood silt loam, 2 to 5 percent slopes	370	0.1
993D2	Gara-Armstrong loams, 9 to 14 percent slopes, moderately eroded	2,600	0.9
1075B	Givin silt loam, benches, 2 to 5 percent slopes	430	0.2
1130	Belinda silt loam, benches, 0 to 2 percent slopes	240	0.1
1131B	Pershing silt loam, benches, 2 to 5 percent slopes	690	0.2
1132B	Weller silt loam, benches, 2 to 5 percent slopes	270	0.1
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	4,280	1.5
1279	Taintor silty clay loam, benches, 0 to 2 percent slopes	610	0.2
1280	Mahaska silty clay loam, benches, 0 to 2 percent slopes	530	0.2
1315	Landes-Perks complex, channeled, 1 to 3 percent slopes	1,770	0.6
1977	Richwood Variant loam, 1 to 3 percent slopes	340	0.1
4000	Urban land, 0 to 2 percent slopes	390	0.1
5010	Pits, sand and gravel	200	0.1
5020	Pits-dumps complex, mines	1,520	0.5
5030	Pits, limestone quarry	270	0.1
6313	Orthents, shaly substratum, 2 to 8 percent slopes	230	0.1
	Water	2,970	1.1
	Total	279,360	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
7----------------------- Wiota	110	42	62	4.6	7.6	4.2
11B--------------------- Colo-Ely	100	38	80	4.1	6.1	3.8
13B--------------------- Humeston-Vesser-Colo	90	34	50	4.0	5.0	3.6
23C--------------------- Arispe	105	40	79	4.4	6.3	3.8
23C2-------------------- Arispe	102	39	76	4.3	6.1	3.7
41B--------------------- Sparta	61	23	45	2.6	3.5	2.3
41C--------------------- Sparta	56	21	42	2.3	3.3	2.0
41E--------------------- Sparta	---	---	---	2.0	2.7	1.3
51---------------------- Vesser	95	36	52	4.0	5.0	3.7
54---------------------- Zook	94	30	72	4.0	4.0	4.0
56B--------------------- Cantril	94	36	52	4.0	5.0	3.3
58D2-------------------- Douds	64	24	33	2.6	3.7	1.9
58E--------------------- Douds	---	---	22	2.2	3.6	1.9
58E2-------------------- Douds	---	---	17	1.7	3.0	1.5
58G--------------------- Douds	---	---	---	---	2.0	1.3
65E--------------------- Lindley	---	---	---	2.0	2.8	2.0
65E2-------------------- Lindley	---	---	---	1.5	2.3	2.0
65F, 65G---------------- Lindley	---	---	---	---	1.7	1.7
75B--------------------- Givin	117	43	64	4.9	8.1	4.2
76B--------------------- Ladoga	113	43	62	4.7	7.8	4.3
76C--------------------- Ladoga	108	41	59	4.5	7.5	4.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
80B-----Clinton	107	41	59	4.5	6.4	4.0
80C-----Clinton	102	39	56	4.3	6.1	3.8
80C2-----Clinton	99	38	54	4.2	6.0	3.6
80D2-----Clinton	90	34	50	3.8	5.3	3.5
88-----Nevin	114	43	63	4.8	8.0	4.0
93D2-----Shelby-Adair	69	26	38	2.9	4.0	2.6
122-----Sperry	97	37	53	3.5	5.1	3.6
130-----Belinda	87	33	48	3.7	6.2	3.7
131B-----Pershing	101	38	56	4.2	7.0	3.8
131C-----Pershing	96	36	53	4.0	6.7	3.5
132B-----Weller	95	36	52	4.0	6.7	3.8
132C-----Weller	90	34	50	3.8	6.4	3.7
133-----Colo	104	40	78	4.2	5.5	4.2
133+-----Colo	98	35	80	4.0	5.3	4.2
173-----Hoopeston	81	30	54	3.4	4.8	2.6
178-----Waukee	98	37	78	4.1	5.8	4.0
179E-----Gara	---	---	---	2.5	3.3	1.7
179E2-----Gara	---	---	---	2.2	2.8	1.5
179F-----Gara	---	---	---	1.5	2.1	1.3
192C2-----Adair	65	25	36	2.7	3.5	2.3
192D-----Adair	62	23	34	2.6	3.3	2.0
192D2-----Adair	54	20	30	2.3	2.9	1.9
208-----Landes	82	29	53	3.3	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
211------------------------ Edina	86	33	47	3.4	6.8	---
220------------------------ Nodaway	110	40	60	3.0	5.5	4.0
222C----------------------- Clarinda	70	26	38	2.7	3.7	2.7
222C2---------------------- Clarinda	60	22	34	2.3	3.3	2.3
223C2---------------------- Rinda	52	20	29	2.1	3.3	2.3
223D2---------------------- Rinda	42	16	23	1.7	2.8	1.7
230C----------------------- Arispe-Clearfield	96	37	53	4.0	6.1	3.6
260------------------------ Beckwith	76	23	42	3.3	5.5	3.0
269------------------------ Humeston	88	30	48	3.7	5.0	3.3
276C2---------------------- Ladoga-Hedrick	104	39	56	4.3	6.8	3.8
279------------------------ Taintor	117	44	64	4.7	7.8	4.2
280------------------------ Mahaska	125	48	69	5.2	8.6	4.5
280B----------------------- Mahaska	119	45	65	5.0	8.3	4.2
281B----------------------- Otley	119	45	65	5.0	8.3	4.3
281C----------------------- Otley	114	43	63	4.8	8.0	4.0
313E----------------------- Gosport	---	---	---	---	2.0	1.3
313E2---------------------- Gosport	---	---	---	---	1.7	1.0
313F----------------------- Gosport	---	---	---	---	---	1.0
315------------------------ Landes-Perks-Nodaway	75	25	40	2.7	---	---
362, 363------------------- Haig	105	40	58	4.2	7.0	3.8
364B----------------------- Grundy	107	41	59	4.5	6.3	3.8
380B----------------------- Mahaska	112	43	62	4.7	8.0	4.1
424D2---------------------- Lindley-Keswick	50	22	34	2.1	3.5	1.6

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
424E. Lindley-Keswick	---	---	---	1.9	3.1	1.6
424E2. Lindley-Keswick	---	---	---	1.8	3.0	1.6
425D. Keswick	52	20	29	2.2	3.1	1.9
425D2. Keswick	44	17	24	1.8	2.7	1.3
451D2. Caleb	66	25	36	2.8	4.0	2.1
453. Tuskeego	88	31	45	3.3	4.3	3.3
478G**. Gosport-Rock outcrop						
520. Coppock	93	34	50	3.7	4.7	3.3
570C. Nira	109	41	60	4.6	7.6	4.1
581C2. Otley-Nira	108	41	59	4.6	7.6	4.0
592C2. Mystic	60	23	33	2.5	3.0	2.1
592D2. Mystic	51	19	28	2.0	2.3	1.9
594C2. Galland	54	20	30	2.3	3.1	1.9
594D2. Galland	45	17	25	1.8	2.7	1.3
594E2. Galland	---	---	---	1.0	2.0	1.0
688. Koszta	108	41	59	4.5	6.5	3.7
715. Nodaway-Landes	90	30	50	3.0	5.5	4.0
730B. Nodaway-Cantril	89	32	52	2.7	5.4	3.3
731C2. Pershing	90	33	50	3.8	6.4	3.4
732C2. Weller	84	31	46	3.2	5.3	3.3
732D2. Weller	75	28	42	2.8	4.7	2.6
779. Kalona	115	44	64	4.7	7.8	4.2
792C2. Armstrong	59	22	33	2.5	3.1	2.1

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
792D----------------------- Armstrong	58	22	32	2.3	3.1	2.0
792D2---------------------- Armstrong	50	19	28	2.0	2.7	1.7
795D2---------------------- Ashgrove	40	13	22	1.8	1.7	1.5
831C2---------------------- Pershing	91	33	50	3.8	6.4	3.4
832C2---------------------- Weller	85	32	46	3.2	5.3	3.5
876B----------------------- Ladoga	113	43	62	4.7	7.8	4.3
876C----------------------- Ladoga	108	41	59	4.5	7.5	4.0
876C2---------------------- Ladoga	105	40	57	4.4	7.3	3.9
880B----------------------- Clinton	107	41	59	4.5	6.4	4.0
880C----------------------- Clinton	102	39	56	4.3	6.1	3.8
880C2---------------------- Clinton	99	38	54	4.2	6.0	3.6
881B----------------------- Otley	119	45	65	5.0	8.3	4.3
881C2---------------------- Otley	111	42	61	4.7	7.8	3.9
892D2---------------------- Mystic Variant	42	16	23	1.7	2.5	1.7
977------------------------ Richwood	122	42	98	5.1	8.5	4.1
977B----------------------- Richwood	120	41	96	5.0	8.3	4.0
993D2---------------------- Gara-Armstrong	67	25	36	2.8	3.9	2.3
1075B---------------------- Givin	117	43	64	4.9	8.1	4.2
1130----------------------- Belinda	87	33	48	3.7	6.2	3.7
1131B---------------------- Pershing	101	38	56	4.2	7.0	3.8
1132B---------------------- Weller	95	36	52	4.0	6.7	3.8
1220----------------------- Nodaway	---	---	---	3.0	5.5	4.0
1279----------------------- Taintor	117	44	64	4.7	7.8	4.2

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
1280----------------------- Mahaska	125	48	69	5.2	8.6	4.5
1315----------------------- Landes-Perks	---	---	---	2.6	---	---
1977----------------------- Richwood Variant	105	40	58	4.4	6.3	4.5
4000**. Urban land						
5010**. Pits						
5020**. Pits-dumps complex						
5030**. Pits						
6313**. Orthents						

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	12,740	---	---	---
II	65,470	23,550	40,780	1,140
III	100,280	75,950	23,520	810
IV	44,590	41,500	2,510	580
V	6,050	---	6,050	---
VI	14,800	14,800	---	---
VII	29,850	29,400	---	450
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
41B, 41C, 41E------ Sparta	3s	Slight	Slight	Severe	Slight	Northern red oak---- Red pine------------ Eastern white pine-- Jack pine-----------	70 --- --- ---	Eastern white pine, red pine, jack pine.
56B---------------- Cantril	2o	Slight	Slight	Slight	Moderate	White oak-----------	75	Eastern white pine, red pine, European larch, white oak, sugar maple.
58D2--------------- Douds	4o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, European larch, sugar maple.
58E, 58E2, 58G*---- Douds	4r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, European larch, white oak, sugar maple.
65E---------------- Lindley	4r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	60 60	White oak, green ash, yellow-poplar, black oak, northern red oak, eastern white pine.
65E2--------------- Lindley	5r	Moderate	Moderate	Moderate	Slight	Black oak-----------	60	White oak, green ash, yellow-poplar, black oak, eastern white pine.
65F, 65G----------- Lindley	4r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	60 60	White oak, green ash, yellow-poplar, black oak, northern red oak, eastern white pine.
76B, 76C----------- Ladoga	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	75 75	Eastern white pine, red pine, European larch, sugar maple, white oak, northern red oak.
80B, 80C, 80C2, 80D2--------------- Clinton	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	75 75	Eastern white pine, red pine, European larch, white oak, northern red oak.
130---------------- Belinda	5w	Slight	Severe	Moderate	Severe	White oak-----------	45	Eastern cottonwood, silver maple, American sycamore, green ash.
131B, 131C--------- Pershing	4c	Slight	Slight	Severe	Slight	White oak-----------	55	Eastern white pine, white oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
132B, 132C--------- Weller	4c	Slight	Slight	Severe	Slight	White oak-----------	55	Eastern white pine, European larch, sugar maple, white oak.
179E, 179E2, 179F-- Gara	3r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, white oak, northern red oak.
208---------------- Landes	1o	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Yellow-poplar------- American sycamore--- Green ash-----------	105 95 --- ---	Eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
220---------------- Nodaway	2o	Slight	Slight	Slight	Moderate	White oak-----------	65	Eastern white pine, red pine, European larch, black walnut, sugar maple.
223C2, 223D2------- Rinda	5w	Slight	Severe	Moderate	Severe	White oak----------- Northern red oak----	45 45	Silver maple, American sycamore, green ash, common hackberry.
260---------------- Beckwith	5w	Slight	Severe	Moderate	Severe	White oak-----------	45	Eastern cottonwood, silver maple, American sycamore, green ash.
276C2*:								
Ladoga------------	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	75 75	Eastern white pine, red pine, European larch, sugar maple, white oak, northern red oak.
Hedrick-----------	2o	Slight	Slight	Slight	Moderate	White oak-----------	75	Eastern white pine, red pine, sugar maple, white oak.
313E, 313E2, 313F-- Gosport	5c	Moderate	Moderate	Severe	Slight	White oak-----------	45	Eastern white pine.
315*:								
Landes------------	1o	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Yellow-poplar------- American sycamore--- Green ash-----------	105 95 --- ---	Eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
315*:								
Perks-------------	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine, European larch, red pine.
Nodaway-----------	2o	Slight	Slight	Slight	Moderate	White oak-----------	65	Eastern white pine, red pine, European larch, black walnut, sugar maple.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
424D2*:								
Lindley	5o	Slight	Slight	Slight	Slight	Black oak	50	White oak, green ash, black oak, eastern white pine.
Keswick	3c	Slight	Slight	Moderate	Slight	White oak Northern red oak	55 55	Eastern white pine, European larch, sugar maple.
424E*:								
Lindley	4r	Moderate	Moderate	Slight	Slight	White oak Northern red oak	60 60	White oak, green ash, yellow-poplar, black oak, eastern white pine.
Keswick	3c	Moderate	Moderate	Moderate	Slight	White oak Northern red oak	55 55	Eastern white pine, European larch, sugar maple.
424E2*:								
Lindley	5r	Moderate	Moderate	Moderate	Slight	Black oak	50	White oak, green ash, black oak, eastern white pine.
Keswick	3c	Moderate	Moderate	Moderate	Slight	White oak Northern red oak	55 55	Eastern white pine, European larch, sugar maple.
425D, 425D2 Keswick	3c	Slight	Slight	Moderate	Slight	White oak Northern red oak	55 55	Eastern white pine, European larch, sugar maple, white oak, northern red oak.
451D2 Caleb	3o	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, black walnut, sugar maple, white oak, northern red oak.
453 Tuskeego	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood Silver maple	90 80	Eastern cottonwood, silver maple, American sycamore, green ash.
478G*:								
Gosport	5c	Moderate	Moderate	Severe	Slight	White oak	45	Eastern white pine, red pine, white spruce.
Rock outcrop.								
520 Coppock	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, European larch, sugar maple.
592C2, 592D2 Mystic	4c	Slight	Slight	Severe	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, sugar maple, northern red oak.
594C2, 694D2 Galland	3c	Slight	Slight	Severe	Moderate	White oak Northern red oak	65 70	Eastern white pine, European larch, sugar maple, northern red oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Plant competi-tion	Common trees	Site index	
594E2 Galland	3c	Moderate	Moderate	Severe	Moderate	White oak Northern red oak	65 70	Eastern white pine, sugar maple, northern red oak.
688 Koszta	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 70	Eastern white pine, red pine, European larch, sugar maple.
715*: Nodaway	2o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, European larch, black walnut, sugar maple.
Landes	1o	Slight	Slight	Slight	Moderate	Eastern cottonwood Yellow-poplar American sycamore Green ash	105 95 --- ---	Eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
730B*: Nodaway	2o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, European larch, black walnut, sugar maple.
Cantril	2o	Slight	Slight	Slight	Moderate	White oak	75	Eastern white pine, red pine, European larch, sugar maple, white oak.
731C2 Pershing	4c	Slight	Slight	Severe	Slight	White oak	55	Eastern white pine, white oak.
732C2, 732D2 Weller	4c	Slight	Slight	Severe	Slight	White oak	55	Eastern white pine, European larch, sugar maple, white oak.
792C2, 792D, 792D2 Armstrong	4c	Slight	Slight	Moderate	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, sugar maple, white oak, northern red oak.
795D2 Ashgrove	5w	Slight	Severe	Moderate	Severe	White oak Northern red oak	45 45	Silver maple, American sycamore, green ash, common hackberry.
831C2 Pershing	4c	Slight	Slight	Severe	Slight	White oak	55	Eastern white pine, white oak.
832C2 Weller	4c	Slight	Slight	Severe	Slight	White oak	55	Eastern white pine, European larch, sugar maple, white oak.
876B, 876C, 876C2 Ladoga	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak	75 75	Eastern white pine, red pine, European larch, sugar maple, white oak, northern red oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
880B, 880C, 880C2--Clinton	2o	Slight	Slight	Slight	Moderate	White oak----------- Northern red oak----	75 75	Eastern white pine, red pine, European larch, white oak, northern red oak.
892D2--------------Mystic Variant	4w	Slight	Severe	Moderate	Severe	White oak----------- Northern red oak----	45 45	Silver maple, American sycamore, green ash, common hackberry.
993D2*:								
Gara---------------	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, white oak, northern red oak.
Armstrong---------	4c	Slight	Slight	Moderate	Slight	White oak----------- Northern red oak----	55 55	Eastern white pine, red pine, European larch, sugar maple, white oak, northern red oak.
1130---------------Belinda	5w	Slight	Severe	Moderate	Severe	White oak-----------	45	Eastern cottonwood, silver maple, American sycamore, green ash.
1131B--------------Pershing	4c	Slight	Slight	Severe	Slight	White oak-----------	55	Eastern white pine, white oak.
1132B--------------Weller	4c	Slight	Slight	Severe	Slight	White oak-----------	55	Eastern white pine, European larch, sugar maple, white oak.
1220---------------Nodaway	2o	Slight	Slight	Slight	Moderate	White oak-----------	65	Eastern white pine, red pine, European larch, black walnut, sugar maple.
1315*:								
Landes------------	1o	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Yellow-poplar------- American sycamore--- Green ash-----------	105 95 --- ---	Eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
Perks-------------	3s	Slight	Slight	Moderate	Slight	White oak-----------	55	Eastern white pine, European larch, red pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
7 Wiota	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
11B*:					
Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, lilac, Tatarian honeysuckle, Zabel honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Silver maple, eastern cottonwood.
Ely	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
13B*:					
Humeston	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, Siberian dogwood.	Amur maple, northern white-cedar, medium purple willow.	Green ash	Eastern cottonwood, silver maple.
Vesser	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle.	Amur maple, northern white-cedar.	Green ash, eastern white pine, common hackberry.	Eastern cottonwood, silver maple.
Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, lilac, Tatarian honeysuckle, Zabel honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Silver maple, eastern cottonwood.
23C, 23C2 Arispe	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
41B, 41C, 41E Sparta	European privet, gray dogwood.	Tatarian honeysuckle, lilac, autumn-olive.	Austrian pine, common hackberry, eastern redcedar.	Eastern white pine, red pine, jack pine, honeylocust.	---
51 Vesser	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle.	Amur maple, northern white-cedar.	Green ash, eastern white pine, common hackberry.	Eastern cottonwood, silver maple.
54 Zook	Silky dogwood, redosier dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle, Siberian dogwood.	Northern white-cedar, Amur maple.	Green ash, common hackberry.	Silver maple, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
56B: Cantril	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
58D2, 58E, 58E2, 58G: Douds	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
65E, 65E2, 65F, 65G: Lindley	Redosier dogwood, gray dogwood.	Amur honeysuckle, autumn-olive.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine, green ash.	Eastern cottonwood, silver maple.
75B: Givin	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
76B, 76C: Ladoga	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
80B, 80C, 80C2, 80D2: Clinton	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
88: Nevin	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
93D2*:					
Shelby	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
Adair	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
122: Sperry	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
130: Belinda	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle, Siberian dogwood.	Amur maple, northern white-cedar.	Green ash, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
131B, 131C-------- Pershing	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
132B, 132C-------- Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
133, 133+--------- Colo	Redosier dogwood, silky dogwood.	Lilac, Tatarian honeysuckle, Zabel honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Silver maple, eastern cottonwood.
173--------------- Hoopeston	Redosier dogwood	Siberian crabapple, Tatarian honeysuckle, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak.	Green ash, eastern white pine, Norway spruce.	Eastern cottonwood, silver maple.
178--------------- Waukee	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
179E, 179E2------- Gara	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
179F-------------- Gara	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern red cedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
192C2, 192D, 192D2------------ Adair	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
208--------------- Landes	Gray dogwood	Amur maple, autumn-olive, American cranberrybush, lilac, Amur honeysuckle, Tatarian honeysuckle.	Eastern redcedar	Red pine, common hackberry, green ash.	Eastern white pine, Norway spruce.
211--------------- Edina	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Amur honeysuckle, lilac.	Amur maple, medium purple willow, northern white-cedar.	Green ash, common hackberry.	Silver maple, eastern cottonwood.
220--------------- Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
222C, 222C2: Clarinda	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, lilac.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
223C2, 223D2: Rinda	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Amur honeysuckle.	Medium purple willow, Amur maple, northern white-cedar.	Green ash, common hackberry, Norway spruce.	Silver maple, eastern cottonwood.
230C*:					
Arispe	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
Clearfield	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry, Norway spruce.	Eastern cottonwood, silver maple.
260: Beckwith	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, lilac.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
269: Humeston	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, Siberian dogwood.	Amur maple, northern white-cedar, medium purple willow.	Green ash	Eastern cottonwood, silver maple.
276C2*:					
Ladoga	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
Hedrick	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
279: Taintor	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, lilac.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
280, 280B: Mahaska	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
281B, 281C: Otley	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
313E, 313E2: Gosport	Redosier dogwood, gray dogwood.	Lilac, Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine, green ash.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
313F Gosport	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, lilac.	Eastern redcedar, Amur maple, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine, green ash.	---
315*:					
Landes	Gray dogwood	Amur maple, autumn-olive, American cranberrybush, lilac, Amur honeysuckle, Tatarian honeysuckle.	Northern white-cedar, eastern redcedar.	Red pine, common hackberry, green ash.	Eastern white pine, Norway spruce.
Perks	European privet, gray dogwood.	Autumn-olive, lilac, Tatarian honeysuckle.	Eastern redcedar, common hackberry, Austrian pine.	Eastern white pine, red pine, jack pine, honeylocust.	---
Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
362, 363 Haig	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, lilac.	Northern white-cedar, Amur maple, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
364B Grundy	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Common hackberry, red pine, eastern white pine, Norway spruce.	Eastern cottonwood, silver maple.
380B Mahaska	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
424D2*, 424E*, 424E2*:					
Lindley	Redosier dogwood, gray dogwood.	Amur honeysuckle	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
Keswick	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, Northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
425D, 425D2 Keswick	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
451D2 Caleb	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
453. Tuskeego	Redosier dogwood, silky dogwood.	Siberian dogwood, Tatarian honeysuckle.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
478G*: Gosport	Redosier dogwood, gray dogwood.	Autumn-olive, Tatarian honeysuckle, Amur honeysuckle.	Eastern redcedar, Amur maple.	Common hackberry, red pine, Norway spruce, Austrian pine, honeylocust.	---
Rock outcrop.					
520. Coppock	Redosier dogwood, silky dogwood.	Tatarian honeysuckle.	Amur maple, northern white-cedar, eastern redcedar.	Red pine, eastern white pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
570C. Nira	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
581C2*: Otley	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
Nira	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
592C2, 592D2. Mystic	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
594C2, 594D2, 594E2. Galland	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
688. Koszta	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
715*: Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar. northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
715*:					
Landes	Gray dogwood	Amur maple, autumn-olive, American cranberrybush, lilac, Amur honeysuckle, Tatarian honeysuckle.	Eastern redcedar	Red pine, common hackberry, green ash.	Eastern white pine, Norway spruce.
730B*:					
Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
Cantril	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
731C2 Pershing	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
732C2, 732D2 Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
779 Kalona	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle.	Amur maple, Norway spruce, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
792C2, 792D, 792D2 Armstrong	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
795D2 Ashgrove	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
831C2 Pershing	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
832C2 Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
876B, 876C, 876C2 Ladoga	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
880B, 880C, 880C2 Clinton	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine, green ash.	Eastern cottonwood, silver maple.
881B, 881C2-------- Otley	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
892D2------------- Mystic Variant	Redosier dogwood, silky dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Green ash, common hackberry, Norway spruce, eastern white pine.	Silver maple, eastern cottonwood.
977, 977B--------- Richwood	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Eastern white pine, red pine, common hackberry, Norway spruce.	Eastern cottonwood, silver maple.
993D2*:					
Gara--------------	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
Armstrong---------	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
1075B------------- Givin	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
1130-------------- Belinda	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Zabel honeysuckle.	Amur maple, northern white-cedar.	Green ash, common hackberry.	Eastern cottonwood, silver maple.
1131B------------- Pershing	Redosier dogwood, gray dogwood.	Siberian dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
1132B------------- Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar, northern white-cedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
1220-------------- Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce, eastern white pine.	Eastern cottonwood, silver maple.
1279-------------- Taintor	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, Zabel honeysuckle, lilac.	Amur maple, northern white-cedar, medium purple willow.	Green ash, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
1280. Mahaska	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, common hackberry, eastern white pine.	Eastern cottonwood, silver maple.
1315*: Landes	---	Amur maple, autumn-olive, American cranberrybush, lilac, Amur honeysuckle, Tatarian honeysuckle.	Eastern redcedar	Red pine, common hackberry, green ash.	Eastern white pine, Norway spruce.
Perks	European privet, gray dogwood.	Autumn-olive, Tatarian honeysuckle.	Eastern redcedar, common hackberry, Austrian pine.	Eastern white pine, red pine, jack pine, honeylocust.	---
1977. Richwood Variant	Redosier dogwood, gray dogwood.	Tatarian honeysuckle.	Eastern redcedar, Amur maple, northern white-cedar.	Red pine, Norway spruce, green ash, eastern white pine.	Silver maple, eastern cottonwood.
4000*. Urban land					
5010*. Pits					
5020*. Pits-dumps complex					
5030*. Pits					
6313*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
7: Wiota	Slight	Slight	Slight	Slight	Slight.
11B*:					
Colo	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: floods.
Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
13B*:					
Humeston	Severe: floods, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: wetness, floods.
Vesser	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Colo	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: floods.
23C, 23C2: Arispe	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
41B: Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: too sandy.
41C: Sparta	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: too sandy.
41E: Sparta	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
51: Vesser	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
54: Zook	Severe: wetness, floods.	Severe: wetness, percs slowly.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
56B: Cantril	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
58D2: Douds	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
58E, 58E2, 58G: Douds	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65E, 65E2, 65F: Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
65G-------------------- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
75B-------------------- Givin	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight------------	Slight.
76B-------------------- Ladoga	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
76C-------------------- Ladoga	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.
80B-------------------- Clinton	Moderate: percs slowly.	Slight----------	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
80C, 80C2-------------- Clinton	Moderate: percs slowly.	Slight----------	Severe: slope.	Severe: erodes easily.	Slight.
80D2------------------- Clinton	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
88--------------------- Nevin	Severe: floods.	Moderate: wetness.	Moderate: wetness.	Slight------------	Slight.
93D2*:					
Shelby----------------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight------------	Moderate: slope.
Adair-----------------	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
122-------------------- Sperry	Severe: percs slowly, wetness, ponding.	Severe: wetness, percs slowly, ponding.	Severe: percs slowly, wetness, ponding.	Severe: wetness, ponding.	Severe: wetness, ponding.
130-------------------- Belinda	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
131B------------------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
131C------------------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
132B------------------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness.	Severe: erodes easily.	Slight.
132C------------------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
133-------------------- Colo	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
133+ Colo	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: floods.
173 Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
178 Waukee	Slight	Slight	Slight	Slight	Slight.
179E, 179E2, 179F Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
192C2 Adair	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D, 192D2 Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
208 Landes	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
211 Edina	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: wetness.
220 Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
222C, 222C2 Clarinda	Severe: percs slowly, wetness.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
223C2 Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
223D2 Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
230C*:					
Arispe	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
Clearfield	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
260 Beckwith	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
269 Humeston	Severe: floods, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
276C2*:					
Ladoga	Slight	Slight	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
276C2*:					
Hedrick	Slight	Slight	Severe: slope.	Slight	Slight.
279 Taintor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
280 Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
280B Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
281B Otley	Slight	Slight	Moderate: slope.	Slight	Slight.
281C Otley	Slight	Slight	Severe: slope.	Slight	Slight.
313E, 313E2 Gosport	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight	Moderate: slope, thin layer.
313F Gosport	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
315*:					
Landes	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Perks	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.
Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
362, 363 Haig	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
364B Grundy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
380B Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
424D2*:					
Lindley	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Keswick	Severe: wetness.	Moderate: wetness, slope.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
424E*, 424E2*:					
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
424E*, 424E2*:					
Keswick	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Severe: slope.
425D, 425D2 Keswick	Severe: wetness.	Moderate: wetness, slope.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
451D2 Caleb	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
453 Tuskeego	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
478G*:					
Gosport	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
Rock outcrop.					
520 Coppock	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
570C Nira	Slight	Slight	Severe: slope.	Slight	Slight.
581C2*:					
Otley	Slight	Slight	Severe: slope.	Slight	Slight.
Nira	Slight	Slight	Severe: slope.	Slight	Slight.
592C2 Mystic	Moderate: percs slowly.	Slight	Severe: slope.	Slight	Slight.
592D2 Mystic	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
594C2 Galland	Moderate: percs slowly.	Slight	Severe: slope.	Slight	Slight.
594D2 Galland	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
594E2 Galland	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
688 Koszta	Severe: floods.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight	Slight.
715*:					
Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
715*: Landes	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
730B*: Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Cantril	Severe: floods.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
731C2 Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey.
732C2 Weller	Moderate: wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey.
732D2 Weller	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: slope, too clayey.
779 Kalona	Severe: wetness.	Moderate: wetness, too clayey.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness, too clayey.
792C2 Armstrong	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
792D, 792D2 Armstrong	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
795D2 Ashgrove	Severe: percs slowly, wetness.	Moderate: slope, wetness, too clayey.	Severe: slope, wetness, percs slowly.	Moderate: wetness, too clayey.	Moderate: wetness, too clayey, slope.
831C2 Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey.
832C2 Weller	Moderate: wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey.
876B Ladoga	Slight	Slight	Moderate: slope.	Slight	Slight.
876C, 876C2 Ladoga	Slight	Slight	Severe: slope.	Slight	Slight.
880B Clinton	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight	Slight.
880C, 880C2 Clinton	Moderate: percs slowly.	Slight	Severe: slope.	Slight	Slight.
881B Otley	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
881C2: Otley	Slight	Slight	Severe: slope.	Slight	Slight.
892D2: Mystic Variant	Severe: wetness, percs slowly.	Moderate: slope, wetness, too clayey.	Severe: slope, percs slowly.	Moderate: wetness, too clayey.	Moderate: slope, wetness, too clayey.
977: Richwood	Slight	Slight	Slight	Slight	Slight.
977B: Richwood	Slight	Slight	Moderate: slope.	Slight	Slight.
993D2*:					
Gara	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Armstrong	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
1075B: Givin	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight	Moderate: wetness.
1130: Belinda	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.
1131B: Pershing	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
1132B: Weller	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
1220: Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
1279: Taintor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1280: Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
1315*:					
Landes	Severe: floods.	Moderate: floods.	Severe: slope.	Moderate: floods.	Severe: floods.
Perks	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.
1977: Richwood Variant	Slight	Slight	Moderate: slope.	Slight	Slight.
4000*. Urban land					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
5010*. Pits					
5020*. Pits-dumps complex					
5030*. Pits					
6313*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
7: Wiota	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11B*:										
Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Poor.
Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
13B*:										
Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Poor.
23C, 23C2: Arispe	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
41B: Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C, 41E: Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
51: Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
54: Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
56B: Cantril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
58D2: Douds	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
58E, 58E2, 58G: Douds	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
65E, 65E2, 65F: Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
65G: Lindley	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
75B: Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
76B: Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
76C: Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
80B: Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
80C, 80C2, 80D2: Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
88 Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
93D2*:										
Shelby	Fair	Good	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
122 Sperry	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
130 Belinda	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
131B Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
131C Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
132B Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
132C Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
133, 133+ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
173 Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
178 Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
179E, 179E2, 179F Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
192C2, 192D, 192D2 Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
208 Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
211 Edina	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
220 Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222C, 222C2 Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
223C2, 223D2 Rinda	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
230C*:										
Arispe	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
Clearfield	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
260 Beckwith	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
269------------------ Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
276C2*:										
Ladoga-------------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
Hedrick.										
279------------------ Taintor	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
280, 280B----------- Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
281B----------------- Otley	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
281C----------------- Otley	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
313E, 313E2, 313F-- Gosport	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
315*:										
Landes-------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Perks---------------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Nodaway------------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
362, 363------------ Haig	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
364B---------------- Grundy	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
380B---------------- Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
424D2*:										
Lindley------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Keswick------------	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
424E*, 424E2*:										
Lindley------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Keswick------------	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
425D, 425D2--------- Keswick	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
451D2--------------- Caleb	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
453------------------ Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
478G*:										
Gosport------------	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
478G*: Rock outcrop.										
520 Coppock	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
570C Nira	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
581C2*:										
Otley	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
Nira	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
592C2, 592D2 Mystic	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
594C2, 594D2, 594E2 Galland	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
688 Koszta	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
715*:										
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
730B*:										
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Cantril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
731C2 Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
732C2, 732D2 Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
779 Kalona	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
792C2, 792D, 792D2 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
795D2 Ashgrove	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
831C2 Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
832C2 Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
876B Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
876C, 876C2 Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
880B Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
880C, 880C2--------- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
881B---------------- Otley	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
881C2--------------- Otley	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
892D2--------------- Mystic Variant	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
977, 977B----------- Richwood	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
993D2*:										
Gara-----------------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
Armstrong-----------	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
1075B--------------- Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1130---------------- Belinda	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
1131B--------------- Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
1132B--------------- Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
1220---------------- Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
1279---------------- Taintor	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
1280---------------- Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1315*:										
Landes--------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Perks---------------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
1977---------------- Richwood Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
4000*. Urban land										
5010*. Pits										
5020*. Pits-dumps complex										
5030*. Pits										

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
6313*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
7----------------- Wiota	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
11B*:						
Colo--------------	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.	Severe: floods.
Ely---------------	Moderate: wetness.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: frost action, low strength.	Slight.
13B*:						
Humeston----------	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: wetness, low strength, floods.	Severe: wetness, floods.
Vesser------------	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, frost action.	Severe: floods.
Colo--------------	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.	Severe: floods.
23C, 23C2---------- Arispe	Moderate: wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
41B---------------- Sparta	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: too sandy.
41C---------------- Sparta	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: too sandy.
41E---------------- Sparta	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51----------------- Vesser	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
54----------------- Zook	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods.
56B---------------- Cantril	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: frost action, low strength.	Slight.
58D2--------------- Douds	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58E, 58E2, 58G---- Douds	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
65E, 65E2, 65F, 65G-------------- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
75B--------------- Givin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
76B, 76C---------- Ladoga	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
80B, 80C, 80C2---- Clinton	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
80D2-------------- Clinton	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
88---------------- Nevin	Severe: wetness.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: frost action, low strength.	Slight.
93D2*: Shelby-----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Adair------------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action, shrink-swell.	Moderate: slope, wetness.
122--------------- Sperry	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength.	Severe: ponding.
130--------------- Belinda	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
131B, 131C-------- Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
132B, 132C-------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
133--------------- Colo	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.	Severe: floods.
133+-------------- Colo	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.	Severe: floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
173 Hoopeston	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
178 Waukee	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.	Slight.
179E, 179E2, 179F Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
192C2 Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action.	Moderate: wetness.
192D, 192D2 Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
208 Landes	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
211 Edina	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
220 Nodaway	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
222C, 222C2 Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, low strength.	Moderate: wetness.
223C2 Rinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Moderate: wetness.
223D2 Rinda	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, slope.	Severe: wetness, frost action, low strength.	Moderate: wetness, slope.
230C*:						
Arispe	Moderate: wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
Clearfield	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
260 Beckwith	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength.	Moderate: wetness.
269 Humeston	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: wetness, low strength, floods.	Severe: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
276C2*:						
Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
Hedrick	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
279 Taintor	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
280, 280B Mahaska	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
281B, 281C Otley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
313E, 313E2 Gosport	Severe: too clayey.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
313F Gosport	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
315*:						
Landes	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Perks	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Nodaway	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
362, 363 Haig	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
364B Grundy	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
380B Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: low strength, frost action.	Slight.
424D2*:						
Lindley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Keswick	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell, frost action.	Moderate: wetness, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
424E*, 424E2*:						
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Keswick	Severe: wetness, slope.	Severe: shrink-swell, wetness, slope.	Severe: shrink-swell, wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell, frost action.	Severe: slope.
425D, 425D2: Keswick	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell, frost action.	Moderate: wetness, slope.
451D2: Caleb	Moderate: slope, wetness.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
453: Tuskeego	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness.
478G*:						
Gosport	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Rock outcrop.						
520: Coppock	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
570C: Nira	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action, low strength.	Slight.
581C2*:						
Otley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Nira	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action, low strength.	Slight.
592C2: Mystic	Moderate: wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
592D2: Mystic	Moderate: slope, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: slope.
594C2: Galland	Moderate: wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: frost action, shrink-swell.	Slight.
594D2: Galland	Moderate: wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
594E2: Galland	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: frost action, low strength, slope.	Severe: slope.
688: Koszta	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, frost action.	Slight.
715*:						
Nodaway	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
Landes	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
730B*:						
Nodaway	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
Cantril	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.	Moderate: wetness.
731C2: Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
732C2: Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
732D2: Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope.	Severe: shrink-swell, frost action, low strength.	Moderate: slope.
779: Kalona	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
792C2: Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell, frost action.	Moderate: wetness.
792D, 792D2: Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope, wetness.	Severe: low strength, shrink-swell, frost action.	Moderate: slope, wetness.
795D2: Ashgrove	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness, slope.
831C2: Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
832C2-------------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell. wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
876B, 876C, 876C2- Ladoga	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
880B, 880C, 880C2- Clinton	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
881B, 881C2-------- Otley	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
892D2-------------- Mystic Variant	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: slope.
977, 977B---------- Richwood	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
993D2*:						
Gara--------------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Armstrong---------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope, wetness.	Severe: low strength, shrink-swell, frost action.	Moderate: slope, wetness.
1075B-------------- Givin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
1130--------------- Belinda	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
1131B-------------- Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
1132B-------------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
1220--------------- Nodaway	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
1279--------------- Taintor	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
1280--------------- Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1315*:						
Landes------------	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Perks-------------	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
1977--------------- Richwood Variant	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
4000*. Urban land						
5010*. Pits						
5020*. Pits-dumps complex						
5030*. Pits						
6313*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
7------------------- Wiota	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
11B*:					
Colo----------------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Ely-----------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
13B*:					
Humeston------------	Severe: wetness, percs slowly, floods.	Severe: floods, wetness.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness.
Vesser--------------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Colo----------------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
23C, 23C2------------ Arispe	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
41B------------------ Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
41C------------------ Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
41E------------------ Sparta	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: slope, too sandy, seepage.
51------------------- Vesser	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
54------------------- Zook	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: too clayey, wetness.
56B------------------ Cantril	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
58D2: Douds	Moderate: wetness, percs slowly.	Severe: slope, seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: slope.
58E, 58E2, 58G: Douds	Severe: slope.	Severe: slope, seepage.	Severe: wetness, seepage, slope.	Severe: slope, seepage.	Poor: slope.
65E, 65E2, 65F: Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
65G: Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
75B: Givin	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
76B: Ladoga	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
76C: Ladoga	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
80B: Clinton	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
80C, 80C2: Clinton	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
80D2: Clinton	Severe: percs slowly, slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
88: Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
93D2*:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Adair	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
122: Sperry	Severe: percs slowly, wetness, ponding.	Severe: wetness, ponding.	Severe: wetness, ponding.	Severe: wetness, ponding.	Poor: wetness, ponding.
130: Belinda	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
131B: Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
131C: Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
132B: Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
132C: Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
133, 133+: Colo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
173: Hoopeston	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
178: Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
179E, 179E2, 179F: Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
192C2, 192D, 192D2: Adair	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
208: Landes	Severe: floods, poor filter.	Severe: seepage, floods.	Severe: floods, wetness, seepage.	Severe: seepage, floods.	Poor: seepage, too sandy.
211: Edina	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
220: Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
222C, 222C2: Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
223C2, 223D2: Rinda	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
230C*:					
Arispe	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Clearfield	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
260: Beckwith	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness. too clayey.	Poor: wetness, too clayey.
269: Humeston	Severe: wetness, percs slowly, floods.	Severe: floods.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
276C2*:					
Ladoga	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Hedrick	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
279 Taintor	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
280, 280B Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
281B Otley	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
281C Otley	Moderate: percs slowly.	Severe: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
313E, 313E2 Gosport	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, area reclaim.
313F Gosport	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, slope, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
315*:					
Landes	Severe: floods, poor filter.	Severe: seepage, floods.	Severe: floods, wetness, seepage.	Severe: floods, seepage, wetness.	Poor: seepage, too sandy.
Perks	Severe: floods, poor filter.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy, seepage.
Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
362, 363 Haig	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
364B Grundy	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
380B Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
424D2*:					
Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Keswick	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
424E*, 424E2*:					
Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Keswick	Severe: percs slowly, wetness, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: wetness, slope.
425D, 425D2 Keswick	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
451D2 Caleb	Moderate: wetness, percs slowly.	Severe: slope, seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: slope.
453 Tuskeego	Severe: wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
478G*:					
Gosport	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, slope, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
Rock outcrop.					
520 Coppock	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
570C Nira	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
581C2*:					
Otley	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Nira	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
592C2, 592D2 Mystic	Severe: percs slowly, wetness.	Severe: slope, wetness, seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too clayey, wetness.
594C2 Galland	Severe: percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage.	Fair: too clayey, wetness.
594D2 Galland	Severe: percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage.	Fair: too clayey, wetness, slope.
594E2 Galland	Severe: slope, percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage, slope.	Poor: slope.
688 Koszta	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
715*:					
Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
Landes	Severe: floods, poor filter.	Severe: seepage, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage.	Poor: seepage, too sandy.
730B*:					
Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
Cantril	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
731C2 Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
732C2 Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
732D2 Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope.
779 Kalona	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness.
792C2, 792D, 792D2 Armstrong	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
795D2 Ashgrove	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
831C2 Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
832C2 Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
876B Ladoga	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
876C, 876C2 Ladoga	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
880B Clinton	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
880C, 880C2 Clinton	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
881B Otley	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
881C2----------------- Otley	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
892D2----------------- Mystic Variant	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
977, 977B------------ Richwood	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
993D2*:					
Gara-----------------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Armstrong-----------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1075B----------------- Givin	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1130------------------ Belinda	Severe: percs slowly, wetness.	Slight------------	Severe: wetness.	Severe: wetness.	Poor: wetness.
1131B----------------- Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
1132B----------------- Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
1220------------------ Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
1279------------------ Taintor	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1280------------------ Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
1315*:					
Landes--------------	Severe: wetness, floods, poor filter.	Severe: seepage, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: seepage, too sandy.
Perks----------------	Severe: floods, poor filter.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy, seepage.
1977------------------ Richwood Variant	Slight------------	Severe: seepage.	Severe: seepage.	Slight------------	Good.
4000*. Urban land					
5010*. Pits					
5020*. Pits-dumps complex					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
5030*. Pits					
6313*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
7 Wiota	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11B*:				
Colo	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ely	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
13B*:				
Humeston	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Vesser	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Colo	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
23C, 23C2 Arispe	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
41B, 41C Sparta	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
41E Sparta	Fair: slope.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
51 Vesser	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
54 Zook	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
56B Cantril	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
58D2 Douds	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
58E, 58E2, 58G Douds	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
65E, 65E2, 65F Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
65G Lindley	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
75B Givin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
76B, 76C. Ladoga	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
80B, 80C, 80C2. Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
80D2. Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
88. Nevin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
93D2*:				
Shelby	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Adair	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
122. Sperry	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
130. Belinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
131B, 131C. Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
132B, 132C. Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
133, 133+. Colo	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
173. Hoopeston	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Good.
178. Waukee	Good	Good	Unsuited: excess fines.	Good.
179E, 179E2, 179F. Gara	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
192C2. Adair	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
192D, 192D2. Adair	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
208. Landes	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
211---------------------- Edina	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
220---------------------- Nodaway	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
222C, 222C2------------ Clarinda	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
223C2------------------ Rinda	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
223D2------------------ Rinda	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer, slope.
230C*:				
Arispe----------------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Clearfield------------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
260---------------------- Beckwith	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
269---------------------- Humeston	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
276C2*:				
Ladoga----------------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Hedrick---------------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
279---------------------- Taintor	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
280, 280B-------------- Mahaska	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
281B, 281C------------- Otley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
313E, 313E2------------ Gosport	Poor: shrink-swell, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
313F-------------------- Gosport	Poor: shrink-swell, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
315*:				
Landes	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
Perks	Good	Good	Unsuited	Fair: too sandy.
Nodaway	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
362, 363 Haig	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
364B Grundy	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
380B Mahaska	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
424D2*:				
Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Keswick	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
424E*, 424E2*:				
Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Keswick	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
425D, 425D2 Keswick	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
451D2 Caleb	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
453 Tuskeego	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
478G*:				
Gosport	Poor: shrink-swell, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, slope.
Rock outcrop.				
520 Coppock	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
570C Nira	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
581C2*:				
Otley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Nira	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
592C2 Mystic	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
592D2 Mystic	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
594C2 Galland	Poor: shrink-swell, low strength.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
594D2 Galland	Poor: shrink-swell, low strength.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
594E2 Galland	Poor: shrink-swell, low strength.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
688 Koszta	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
715*:				
Nodaway	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Landes	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
730B*:				
Nodaway	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Cantril	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
731C2 Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
732C2 Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
732D2 Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
779 Kalona	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
792C2 Armstrong	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
792D, 792D2 Armstrong	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
795D2------------------ Ashgrove	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
831C2------------------ Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
832C2------------------ Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
876B, 876C, 876C2----- Ladoga	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
880B, 880C, 880C2----- Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
881B, 881C2----------- Otley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
892D2------------------ Mystic Variant	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
977, 977B-------------- Richwood	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
993D2*:				
Gara------------------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Armstrong-------------	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
1075B------------------ Givin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1130------------------- Belinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1131B------------------ Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1132B------------------ Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1220------------------- Nodaway	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
1279------------------- Taintor	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
1280------------------- Mahaska	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1315*:				
Landes	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
Perks	Good	Good	Unsuited	Fair: too sandy.
1977 Richwood Variant	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4000*. Urban land				
5010*. Pits				
5020*. Pits-dumps complex				
5030*. Pits				
6313*. Orthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
7: Wiota	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
11B*:						
Colo	Seepage	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
Ely	Seepage	Hard to pack	Not needed	Favorable	Erodes easily	Erodes easily.
13B*:						
Humeston	Favorable	Wetness, hard to pack.	Percs slowly, frost action, floods.	Wetness, percs slowly, floods.	Wetness, percs slowly.	Percs slowly, wetness.
Vesser	Seepage	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Wetness, erodes easily.	Erodes easily, wetness.
Colo	Seepage	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
23C, 23C2: Arispe	Slope	Hard to pack	Not needed	Slope	Erodes easily	Erodes easily.
41B: Sparta	Seepage	Piping, seepage.	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
41C: Sparta	Slope, seepage.	Piping, seepage.	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
41E: Sparta	Slope, seepage.	Piping, seepage.	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing, slope.	Slope, droughty.
51: Vesser	Seepage	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Not needed	Erodes easily, wetness.
54: Zook	Favorable	Hard to pack, wetness.	Floods, percs slowly, frost action.	Floods, wetness, percs slowly.	Not needed	Wetness, percs slowly.
56B: Cantril	Seepage	Wetness	Frost action	Wetness	Wetness	Favorable.
58D2: Douds	Slope, seepage.	Favorable	Not needed	Slope	Slope	Slope.
58E, 58E2, 58G: Douds	Slope, seepage.	Favorable	Not needed	Slope	Slope	Slope.
65E, 65E2, 65F, 65G: Lindley	Slope	Favorable	Not needed	Slope	Slope	Slope.
75B: Givin	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
76B: Ladoga	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
76C: Ladoga	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
80B: Clinton	Seepage	Favorable	Not needed	Erodes easily	Erodes easily	Erodes easily.

* See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
80C, 80C2: Clinton	Slope, seepage.	Favorable	Not needed	Erodes easily, slope.	Erodes easily	Erodes easily.
80D2: Clinton	Slope, seepage.	Favorable	Not needed	Erodes easily, slope.	Erodes easily, slope.	Slope, erodes easily.
88: Nevin	Seepage	Wetness	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
93D2*:						
Shelby	Slope	Favorable	Not needed	Slope	Slope	Slope.
Adair	Slope	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, slope, percs slowly.
122: Sperry	Favorable	Wetness	Percs slowly, frost action, ponding.	Percs slowly, wetness, ponding.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, erodes easily.
130: Belinda	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.	Wetness, erodes easily, percs slowly.
131B: Pershing	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly, wetness, erodes easily.	Erodes easily, percs slowly.
131C: Pershing	Slope	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, erodes easily.	Erodes easily, percs slowly.
132B: Weller	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, erodes easily, percs slowly.	Percs slowly, erodes easily.
132C: Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily, percs slowly.	Percs slowly, erodes easily.
133, 133+: Colo	Seepage	Hard to pack	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
173: Hoopeston	Seepage	Seepage	Frost action	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
178: Waukee	Seepage	Seepage	Not needed	Favorable	Too sandy	Favorable.
179E, 179E2, 179F: Gara	Slope	Favorable	Not needed	Slope	Slope	Slope.
192C2: Adair	Slope	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Percs slowly, wetness.
192D, 192D2: Adair	Slope	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, slope, percs slowly.
208: Landes	Seepage	Seepage, piping.	Not needed	Soil blowing, floods.	Soil blowing	Favorable.
211: Edina	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir area	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
220 Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Erodes easily	Erodes easily.
222C, 222C2 Clarinda	Slope	Wetness, hard to pack.	Percs slowly, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Wetness, erodes easily.
223C2 Rinda	Slope	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, wetness.
223D2 Rinda	Slope	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Erodes easily, wetness, slope.	Wetness, slope, erodes easily.
230C*:						
Arispe	Slope	Hard to pack	Not needed	Slope	Erodes easily	Erodes easily.
Clearfield	Slope, wetness.	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Wetness, erodes easily.
260 Beckwith	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.	Wetness, erodes easily, percs slowly.
269 Humeston	Favorable	Wetness, hard to pack.	Percs slowly, frost action, floods.	Wetness, percs slowly, floods.	Wetness, percs slowly.	Percs slowly, wetness.
276C2*:						
Ladoga	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
Hedrick	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
279 Taintor	Favorable	Wetness, hard to pack.	Frost action	Wetness.	Wetness, erodes easily.	Wetness, erodes easily.
280 Mahaska	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
280B Mahaska	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
281B Otley	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
281C Otley	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
313E, 313E2, 313F Gosport	Slope, depth to rock.	Thin layer, hard to pack.	Not needed	Percs slowly, rooting depth, slope.	Slope, erodes easily, depth to rock.	Slope, erodes easily, depth to rock.
315*:						
Landes	Seepage	Seepage, piping.	Not needed	Soil blowing, floods.	Soil blowing	Favorable.
Perks	Seepage	Seepage	Not needed	Droughty, soil blowing, floods.	Too sandy, soil blowing.	Droughty.
Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Erodes easily	Erodes easily.
362, 363 Haig	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly, erodes easily.	Wetness, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
364B Grundy	Favorable	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, percs slowly, erodes easily.	Wetness, erodes easily.
380B Mahaska	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
424D2*:						
Lindley	Slope	Favorable	Not needed	Slope	Slope	Slope.
Keswick	Slope	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Percs slowly, wetness, slope.	Wetness, slope, erodes easily.
424E*, 424E2*:						
Lindley	Slope	Favorable	Not needed	Slope	Slope	Slope.
Keswick	Slope	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Slope, percs slowly, wetness.	Wetness, slope, erodes easily.
425D, 425D2 Keswick	Slope	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Percs slowly, wetness, slope.	Wetness, slope, erodes easily.
451D2 Caleb	Slope, seepage.	Favorable	Not needed	Slope	Slope	Slope.
453 Tuskeego	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
478G*:						
Gosport	Slope, depth to rock.	Thin layer, hard to pack.	Not needed	Percs slowly, rooting depth, slope.	Slope, erodes easily, depth to rock.	Slope, erodes easily, depth to rock.
Rock outcrop.						
520 Coppock	Seepage	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Wetness, erodes easily.	Wetness, erodes easily.
570C Nira	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
581C2*:						
Otley	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
Nira	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
592C2 Mystic	Slope, seepage.	Favorable	Percs slowly, frost action, slope.	Erodes easily, percs slowly, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
592D2 Mystic	Slope, seepage.	Favorable	Percs slowly, frost action, slope.	Erodes easily, percs slowly, slope.	Percs slowly, erodes easily, slope.	Slope, erodes easily, percs slowly.
594C2 Galland	Slope, seepage.	Favorable	Not needed	Erode easily, percs slowly, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
594D2 Galland	Slope, seepage.	Favorable	Not needed	Erodes easily, percs slowly, slope.	Percs slowly, erodes easily, slope.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
594E2-------------- Galland	Slope, seepage.	Favorable------	Not needed-----	Erodes easily, percs slowly, slope.	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
688--------------- Koszta	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
715*:						
Nodaway----------	Seepage--------	Favorable------	Not needed-----	Floods, erodes easily.	Erodes easily	Erodes easily.
Landes-----------	Seepage--------	Seepage, piping.	Not needed-----	Soil blowing, floods.	Soil blowing	Favorable.
730B*:						
Nodaway----------	Seepage--------	Favorable------	Not needed-----	Floods, erodes easily.	Not needed-----	Erodes easily.
Cantril----------	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness--------	Favorable.
731C2------------- Pershing	Slope----------	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, erodes easily.	Erodes easily, percs slowly.
732C2------------- Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily, percs slowly.	Percs slowly, erodes easily.
732D2------------- Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily, slope.	Slope, percs slowly, erodes easily.
779--------------- Kalona	Favorable------	Hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily.	Wetness, percs slowly, erodes easily.
792C2------------- Armstrong	Slope----------	Wetness--------	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, slope.	Percs slowly.
792D, 792D2------- Armstrong	Slope----------	Wetness--------	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, slope.	Percs slowly, slope.
795D2------------- Ashgrove	Slope----------	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Slope, wetness, erodes easily.
831C2------------- Pershing	Slope----------	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, erodes easily.	Erodes easily, percs slowly.
832C2------------- Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Percs slowly, erodes easily.
876B-------------- Ladoga	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
876C, 876C2------- Ladoga	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
880B-------------- Clinton	Seepage--------	Favorable------	Not needed-----	Erodes easily	Erodes easily	Erodes easily.
880C, 880C2------- Clinton	Slope, seepage.	Favorable------	Not needed-----	Erodes easily, slope.	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
881B Otley	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
881C2 Otley	Slope, seepage.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
892D2 Mystic Variant	Favorable	Hard to pack, wetness.	Percs slowly, frost action, slope.	Wetness, slow intake, slope.	Erodes easily, wetness, percs slowly.	Wetness, slope, erodes easily.
977 Richwood	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
977B Richwood	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
993D2*:						
Gara	Slope	Favorable	Not needed	Slope	Slope	Slope.
Armstrong	Slope	Wetness	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness. slope.	Percs slowly, slope.
1075B Givin	Seepage	Wetness	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
1130 Belinda	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.	Wetness, erodes easily, percs slowly.
1131B Pershing	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly, wetness, erodes easily.	Erodes easily, percs slowly.
1132B Weller	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, percs slowly, erodes easily.	Percs slowly, erodes easily.
1220 Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Erodes easily	Erodes easily.
1279 Taintor	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily.	Wetness, erodes easily, percs slowly.
1280 Mahaska	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
1315*:						
Landes	Seepage	Seepage, piping.	Not needed	Soil blowing, floods.	Soil blowing	Droughty.
Perks	Seepage	Seepage	Not needed	Droughty, soil blowing, floods.	Too sandy, soil blowing.	Droughty.
1977 Richwood Variant	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
4000*. Urban land						
5010*. Pits						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
5020*. Pits-dumps complex						
5030*. Pits						
6313*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
7----------------- Wiota	0-20	Silt loam-------	CL	A-6	0	100	100	100	90-95	30-40	10-20
	20-50	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	15-25
	50-72	Silt loam	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
11B*: Colo---------------	0-10	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	10-72	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
Ely---------------	0-34	Silty clay loam	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	34-60	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
13B*: Humeston----------	0-14	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	14-22	Silt loam-------	CL, CL-ML, ML	A-6, A-4 A-4	0	100	100	95-100	95-100	25-45	5-15
	22-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
Vesser------------	0-15	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	15-30	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	30-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-55	20-30
Colo---------------	0-10	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	10-72	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
23C, 23C2---------- Arispe	0-10	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	10-39	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	39-60	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
41B, 41C, 41E------ Sparta	0-39	Loamy fine sand	SM, ML	A-2, A-4	0	100	100	60-95	20-55	---	NP
	39-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	100	100	60-95	5-50	---	NP
51----------------- Vesser	0-15	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	15-30	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	30-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-55	20-30
54----------------- Zook	0-24	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	24-62	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
56B---------------- Cantril	0-17	Loam------------	CL	A-6	0	100	100	85-95	65-75	30-40	10-20
	17-60	Clay loam-------	CL	A-6, A-7	0	100	100	90-100	70-88	35-45	15-25
58D2, 58E, 58E2, 58G---------------- Douds	0-11	Loam------------	CL	A-6	0	90-100	80-100	70-90	60-80	25-35	10-20
	11-34	Clay loam, loam, sandy clay loam.	CL, SC	A-6, A-7	0	85-100	80-100	70-80	35-60	30-45	15-25
	34-60	Stratified clay loam to loamy sand.	SC, SM, CL, ML	A-4, A-6, A-2	0	85-100	80-100	65-85	20-60	15-35	NP-15
65E, 65E2, 65F, 65G---------------- Lindley	0-8	Loam------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
	8-42	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
	42-79	Loam------------	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
75B----------------- Givin	0-11	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	11-32	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	32-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
76B, 76C----------- Ladoga	0-11	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	11-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-70	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
80B, 80C, 80C2, 80D2-------------- Clinton	0-11	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	11-34	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	34-86	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
88----------------- Nevin	0-19	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	19-56	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	56-72	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
93D2*: Shelby--------------	0-7	Clay loam--------	CL	A-6	0	90-100	85-95	75-90	55-70	30-40	10-20
	7-42	Clay loam--------	CL	A-6, A-7	0-5	90-100	85-95	75-90	55-70	30-45	15-25
	42-72	Clay loam--------	CL	A-6	0-5	90-100	85-95	75-90	55-70	30-40	15-25
Adair---------------	0-7	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	11-20
	7-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
122---------------- Sperry	0-20	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	20-34	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	34-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	20-30
130---------------- Belinda	0-8	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	8-16	Silt loam--------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	16-36	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	36-75	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
131B, 131C--------- Pershing	0-9	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	9-32	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	32-72	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
132B, 132C--------- Weller	0-16	Silt loam--------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	5-15
	16-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	44-64	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
133---------------- Colo	0-10	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	10-72	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
133+--------------- Colo	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	10-72	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
173---------------- Hoopeston	0-40	Fine sandy loam	SM	A-2, A-4	0	90-100	90-100	70-90	25-45	20-35	NP-10
	40-60	Loamy sand, sand, fine sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
178 Waukee	0-18	Loam	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	18-38	Loam, sandy clay loam.	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	38-60	Gravelly sand, loamy coarse sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
179E, 179E2, 179F Gara	0-11	Loam	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	11-40	Clay loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
192C2 Adair	0-7	Clay loam	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	7-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
192D Adair	0-13	Silty clay loam, clay loam.	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	13-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
192D2 Adair	0-7	Clay loam	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	7-43	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	43-60	Clay loam	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
208 Landes	0-19	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	95-100	85-95	35-55	25-40	NP-10
	19-72	Stratified sand to silt loam.	SM, ML, SC, SP	A-2, A-4, A-3	0	100	95-100	60-95	3-70	<30	NP-10
211 Edina	0-23	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	23-52	Silty clay	CH	A-7	0	100	100	95-100	90-100	55-75	30-45
	52-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-60	15-35
220 Nodaway	0-64	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
222C, 222C2 Clarinda	0-10	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	10-39	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	39-72	Clay	CH	A-7	0	95-100	95-100	80-95	75-90	50-60	35-45
223C2, 223D2 Rinda	0-7	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	7-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
230C*:											
Arispe	0-10	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	10-39	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	39-60	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
Clearfield	0-16	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
	16-40	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-60	25-35
	40-60	Silty clay, silty clay loam, clay.	CH	A-7	0	100	100	95-100	80-90	55-70	35-45
260 Beckwith	0-8	Silt loam	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	8-15	Silt loam	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	15-36	Silty clay	CH	A-7	0	100	100	100	95-100	55-70	30-40
	36-70	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
269---------------- Humeston	0-14	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	14-22	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	22-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
276C2*:											
Ladoga------------	0-11	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	11-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-70	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
Hedrick-----------	0-7	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	7-25	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	25-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
279---------------- Taintor	0-20	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	20-30
	20-46	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	46-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
280, 280B---------- Mahaska	0-23	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	23-46	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	46-70	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
281B, 281C--------- Otley	0-16	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	16-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
313E, 313E2, 313F-- Gosport	0-7	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	7-27	Clay, silty clay	CH	A-7	0	100	100	95-100	85-100	50-65	35-50
	27-72	Weathered bedrock.	CH	A-7	0	100	100	95-100	85-100	65-80	50-60
315*:											
Landes------------	0-19	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	95-100	85-95	35-55	25-40	NP-10
	19-72	Stratified sand to silt loam.	SM, ML, SP	A-2, A-4, A-3	0	100	95-100	60-95	3-70	<30	NP-10
Perks-------------	0-9	Loamy sand------	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
	9-72	Sand, loamy sand	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
Nodaway-----------	0-64	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
362---------------- Haig	0-11	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	11-22	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	22-36	Silty clay------	CH	A-7	0	100	100	100	95-100	50-65	30-40
	36-72	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	20-30
363---------------- Haig	0-11	Silty clay loam	CL, CH, ML	A-7	0	100	100	100	95-100	40-55	15-25
	11-22	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	22-36	Silty clay------	CH	A-7	0	100	100	100	95-100	50-65	30-40
	36-72	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
364B---------------- Grundy	0-10	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-20
	10-19	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	90-100	45-55	25-35
	19-28	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-70	30-45
	28-86	Silty clay loam	CH, CL	A-7	0	100	100	90-100	90-100	40-55	25-35
380B---------------- Mahaska	0-23	Silt loam--------	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	23-46	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	46-70	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
424D2*, 424E*, 424E2*:											
Lindley-----------	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
	8-42	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
	42-79	Loam-------------	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
Keswick-----------	0-11	Loam, clay loam	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	11-50	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	50-60	Clay loam, sandy clay loam.	CL, SC	A-6	0-5	90-100	80-100	65-85	40-70	30-40	15-25
425D, 425D2--------- Keswick	0-11	Loam, clay loam	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	11-50	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	50-60	Clay loam, sandy clay loam.	CL, SC	A-6	0-5	90-100	80-100	65-85	40-70	30-40	15-25
451D2--------------- Caleb	0-7	Loam-------------	CL	A-6	0	90-100	80-100	70-90	60-80	30-40	10-20
	7-36	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	85-100	80-100	60-80	50-75	35-45	15-25
	36-72	Sandy clay loam, sandy loam, clay loam.	SC, CL, SM, ML	A-4, A-6, A-2	0	85-100	80-100	50-75	30-60	15-35	NP-15
453----------------- Tuskeego	0-18	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	98-100	95-100	25-35	5-15
	18-49	Silty clay loam, silty clay.	CH	A-7	0	100	100	98-100	95-100	50-60	25-35
	49-60	Silty clay loam	CH, CL	A-7	0	100	100	98-100	95-100	45-55	25-35
478G*:											
Gosport------------	0-7	Silty clay loam	ML, MH	A-7	0	100	100	95-100	85-100	41-55	11-20
	7-27	Clay, silty clay	CH	A-7	0	100	100	95-100	85-100	50-65	35-50
	27-72	Weathered bedrock.	CH	A-7	0	100	100	95-100	85-100	65-80	50-60
Rock outcrop.											
520----------------- Coppock	0-8	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	8-20	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	20-45	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
	45-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
570C---------------- Nira	0-12	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-25
	12-30	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	30-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
581C2*:											
Otley--------------	0-16	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	16-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
581C2*:											
Nira----------------	0-12	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-25
	12-30	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	30-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
592C2, 592D2-------- Mystic	0-8	Silt loam--------	CL, ML	A-4, A-6, A-7	0-5	90-100	95-100	95-100	65-90	30-45	5-20
	8-51	Clay loam, clay, silty clay.	CL, CH	A-6, A-7	0-5	90-100	95-100	95-100	65-80	40-55	25-35
	51-65	Sandy clay loam, loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	95-100	90-95	40-65	25-40	5-20
594C2, 594D2, 594E2-------------- Galland	0-6	Loam-------------	CL	A-6	0-5	90-100	80-100	75-100	65-90	30-40	10-20
	6-38	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	38-60	Sandy loam, sandy clay loam, loam.	SM-SC, SC, CL, CL-ML	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
688----------------- Koszta	0-14	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
	14-60	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
715*:											
Nodaway------------	0-64	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Landes-------------	0-19	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	95-100	85-95	35-55	25-40	NP-10
	19-72	Stratified sand to silt loam.	SM, ML, SP	A-2, A-4, A-3	0	100	95-100	60-95	3-70	<30	NP-10
730B*:											
Nodaway------------	0-64	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Cantril------------	0-17	Loam-------------	CL	A-6	0	100	100	85-95	65-75	30-40	10-20
	17-60	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-88	35-45	15-25
731C2--------------- Pershing	0-6	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
	6-32	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	32-72	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
732C2, 732D2-------- Weller	0-6	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	6-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	44-64	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
779----------------- Kalona	0-15	Silty clay loam	MH	A-7	0	100	100	100	95-100	50-65	20-30
	15-30	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	30-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
792C2, 792D, 792D2- Armstrong	0-8	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	8-44	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	44-68	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
795D2--------------- Ashgrove	0-5	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-45	15-25
	5-8	Silty clay, silty clay loam.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	8-68	Clay-------------	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
831C2--------------- Pershing	0-6	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
	6-32	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	32-72	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
832C2--------------- Weller	0-6	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	6-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	44-64	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
876B, 876C, 876C2-- Ladoga	0-11	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	11-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-70	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
880B, 880C, 880C2-- Clinton	0-11	Silt loam-------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	11-34	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	34-86	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
881B, 881C2-------- Otley	0-16	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	16-31	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	31-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30
892D2-------------- Mystic Variant	0-7	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	65-90	40-55	15-25
	7-18	Clay loam-------	CL	A-6, A-7	0	100	95-100	90-100	65-80	35-45	20-30
	18-68	Clay, clay loam	CH	A-7	0	95-100	80-95	70-90	55-80	50-70	35-45
977, 977B---------- Richwood	0-15	Silt loam-------	ML	A-4	0	100	100	90-100	85-95	25-35	3-10
	15-40	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	20-35	5-15
	40-60	Stratified silt loam to loamy sand.	CL, ML, SC, SM	A-4 A-2	0	100	100	85-95	35-75	<25	2-10
993D2*:											
Gara--------------	0-11	Loam-----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	11-40	Clay loam-------	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong---------	0-8	Loam-----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	8-44	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-60	20-30
	44-68	Clay loam-------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1075B-------------- Givin	0-11	Silt loam-------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	11-32	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	32-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
1130--------------- Belinda	0-8	Silt loam-------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	8-16	Silt loam-------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	16-36	Silty clay------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	36-75	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
1131B-------------- Pershing	0-9	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	9-32	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	32-72	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
1132B-------------- Weller	0-16	Silt loam-------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	5-15
	16-44	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	44-64	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1220---------------- Nodaway	0-64	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
1279---------------- Taintor	0-20	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	20-30
	20-46	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	46-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
1280---------------- Mahaska	0-23	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	23-46	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	46-70	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
1315*:											
Landes-------------	0-19	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	95-100	85-95	35-55	25-40	NP-10
	19-72	Stratified sand to silt loam.	SM, ML, SC, SP	A-2, A-4, A-3	0	100	95-100	60-95	3-70	<30	NP-10
Perks--------------	0-9	Loamy sand-------	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
	9-72	Sand, loamy sand	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
1977---------------- Richwood Variant	0-22	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	50-70	20-35	5-15
	22-49	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	50-70	20-35	5-15
	49-60	Loam, sandy loam	CL-ML, SC, SM-SC, CL	A-4	0	95-100	90-100	70-90	40-60	20-30	5-10
4000*. Urban land											
5010*. Pits											
5020*. Pits-dumps complex											
5030*. Pits											
6313*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
7----------------- Wiota	0-20	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	20-50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		
	50-72	0.6-2.0	0.18-0.20	6.1-6.5	Moderate------	0.43		
11B*:								
Colo-------------	0-10	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	10-72	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
Ely--------------	0-34	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	34-60	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.43		
13B*:								
Humeston---------	0-14	0.2-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	4	7
	14-22	0.2-2.0	0.20-0.22	4.5-6.0	Moderate------	0.32		
	22-60	<0.06	0.13-0.15	4.5-6.5	High----------	0.32		
Vesser-----------	0-15	0.6-2.0	0.20-0.24	5.6-7.3	Moderate------	0.32	5	7
	15-30	0.6-2.0	0.18-0.22	5.1-6.0	Moderate------	0.43		
	30-60	0.6-2.0	0.17-0.21	5.6-6.5	Moderate------	0.43		
Colo-------------	0-10	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	10-72	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
23C, 23C2--------- Arispe	0-10	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.32	5	4
	10-39	0.2-0.6	0.18-0.20	5.6-7.3	High----------	0.43		
	39-60	0.2-0.6	0.18-0.20	6.1-7.3	High----------	0.43		
41B, 41C, 41E---- Sparta	0-39	6.0-2.0	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2
	39-60	6.0-20	0.06-0.10	5.1-6.0	Low-----------	0.17		
51---------------- Vesser	0-15	0.6-2.0	0.20-0.24	5.6-7.3	Moderate------	0.32	5	7
	15-30	0.6-2.0	0.18-0.22	5.1-6.0	Moderate------	0.43		
	30-60	0.6-2.0	0.17-0.21	5.6-6.5	Moderate------	0.43		
54---------------- Zook	0-24	0.2-0.6	0.21-0.23	5.6-7.8	High----------	0.28	5	7
	24-62	0.06-0.2	0.11-0.13	5.6-7.8	High----------	0.28		
56B--------------- Cantril	0-17	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.32	5	6
	17-60	0.6-2.0	0.14-0.16	5.1-6.5	Moderate------	0.32		
58D2, 58E, 58E2, 58G-------------- Douds	0-11	0.6-2.0	0.15-0.17	5.1-7.3	Low-----------	0.32	5-4	6
	11-34	0.6-2.0	0.15-0.17	4.5-6.0	Moderate------	0.32		
	34-60	0.6-6.0	0.11-0.13	5.1-7.3	Low-----------	0.32		
65E, 65E2, 65F, 65G-------------- Lindley	0-8	0.6-2.0	0.16-0.18	4.5-7.3	Low-----------	0.32	5	6
	8-42	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
	42-79	0.2-0.6	0.12-0.16	5.6-7.8	Moderate------	0.32		
75B--------------- Givin	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.32	5	6
	11-32	0.2-0.6	0.18-0.20	5.1-5.5	Moderate------	0.43		
	32-60	0.2-0.6	0.18-0.20	5.1-5.5	Moderate------	0.43		
76B, 76C---------- Ladoga	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6
	11-31	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	31-70	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
80B, 80C, 80C2, 80D2------------ Clinton	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37	5	6
	11-34	0.2-0.6	0.16-0.20	5.1-6.0	Moderate------	0.37		
	34-86	0.6-2.0	0.18-0.20	6.1-6.5	Moderate------	0.37		
88--------------- Nevin	0-19	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	19-56	0.6-2.0	0.18-0.20	5.6-6.5	Moderate------	0.43		
	56-72	0.6-2.0	0.18-0.20	6.6-7.3	Moderate------	0.43		
93D2*:								
Shelby----------	0-7	0.6-2.0	0.16-0.18	5.6-7.3	Moderate------	0.28	5	6
	7-42	0.2-0.6	0.16-0.18	5.6-7.8	Moderate------	0.28		
	42-72	0.2-0.6	0.16-0.18	6.6-8.4	Moderate------	0.37		
Adair-----------	0-7	0.2-0.6	0.17-0.19	5.6-7.3	Moderate------	0.32	2	6
	7-43	0.06-0.2	0.13-0.16	5.1-7.8	High----------	0.32		
	43-60	0.2-0.6	0.14-0.16	5.6-7.8	Moderate------	0.32		
122-------------- Sperry	0-20	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.28	5	6
	20-34	0.06-0.2	0.14-0.16	5.1-6.5	High----------	0.43		
	34-60	0.2-0.6	0.19-0.21	5.6-6.5	High----------	0.43		
130-------------- Belinda	0-8	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	4	6
	8-16	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37		
	16-36	<0.06	0.12-0.14	4.5-5.5	High----------	0.37		
	36-75	0.06-0.6	0.18-0.20	5.1-6.0	High----------	0.28		
131B, 131C------- Pershing	0-9	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6
	9-32	0.06-0.2	0.18-0.20	4.5-6.0	High----------	0.37		
	32-72	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
132B, 132C------- Weller	0-16	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.28	5	6
	16-44	0.06-0.2	0.12-0.18	4.5-6.0	High----------	0.43		
	44-64	0.2-0.6	0.18-0.20	5.1-6.0	High----------	0.43		
133-------------- Colo	0-10	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7
	10-72	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
133+------------- Colo	0-10	0.6-2.0	0.22-0.24	6.6-7.3	Moderate------	0.28	5	6
	10-72	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28		
173-------------- Hoopeston	0-40	2.0-6.0	0.12-0.15	5.1-7.3	Low-----------	0.28	4	3
	40-60	6.0-20.0	0.05-0.10	5.6-7.8	Low-----------	0.28		
178-------------- Waukee	0-18	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.24	4	6
	18-38	0.6-2.0	0.15-0.19	5.1-6.0	Low-----------	0.32		
	38-60	>20	0.02-0.06	5.6-6.0	Low-----------	0.10		
179E, 179E2, 179F------------ Gara	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.28	5	6
	11-40	0.2-0.6	0.16-0.18	4.5-7.3	Moderate------	0.28		
	40-60	0.2-0.6	0.16-0.18	6.6-7.8	Moderate------	0.37		
192C2------------ Adair	0-7	0.2-0.6	0.17-0.19	5.6-7.3	Moderate------	0.32	2	6
	7-43	0.06-0.2	0.13-0.16	5.1-6.5	High----------	0.32		
	43-60	0.2-0.6	0.14-0.16	5.6-7.8	Moderate------	0.32		
192D------------- Adair	0-13	0.2-0.6	0.17-0.19	5.6-7.3	Moderate------	0.32	2	6
	13-43	0.06-0.2	0.13-0.16	5.1-6.5	High----------	0.32		
	43-60	0.2-0.6	0.14-0.16	5.6-7.8	Moderate------	0.32		
192D2------------ Adair	0-7	0.2-0.6	0.17-0.19	5.6-7.3	Moderate------	0.32	2	6
	7-43	0.06-0.2	0.13-0.16	5.1-6.5	High----------	0.32		
	43-60	0.2-0.6	0.14-0.16	5.6-7.8	Moderate------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
208---------------- Landes	0-19	2.0-6.0	0.10-0.12	6.1-7.8	Low------------	0.20	5	3
	19-72	6.0-20	0.05-0.10	6.1-7.8	Low------------	0.20		
211---------------- Edina	0-23	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.37	4	6
	23-52	<0.06	0.11-0.13	5.6-7.3	High-----------	0.37		
	52-60	0.06-0.2	0.18-0.20	6.6-7.3	High-----------	0.37		
220---------------- Nodaway	0-64	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
222C, 222C2------- Clarinda	0-10	0.2-0.6	0.17-0.19	5.1-7.3	Moderate------	0.37	3	7
	10-39	<0.06	0.14-0.16	5.1-7.3	High-----------	0.37		
	39-72	<0.06	0.14-0.16	5.6-7.3	High-----------	0.37		
223C2, 223D2------ Rinda	0-7	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.43	3	6
	7-60	<0.06	0.14-0.16	5.1-7.8	High-----------	0.32		
230C*:								
Arispe-----------	0-10	0.6-2.0	0.21-0.23	5.6-7.3	High-----------	0.32	5	4
	10-39	0.2-0.6	0.18-0.20	5.6-7.3	High-----------	0.43		
	39-60	0.2-0.6	0.18-0.20	6.6-7.3	High-----------	0.43		
Clearfield-------	0-16	0.2-0.6	0.21-0.23	5.6-7.3	High-----------	0.28	5	7
	16-40	0.2-0.6	0.18-0.20	5.6-7.3	High-----------	0.43		
	40-60	<0.06	0.10-0.12	5.6-7.3	High-----------	0.43		
260---------------- Beckwith	0-8	0.6-2.0	0.22-0.24	4.5-7.3	Low------------	0.37	5	6
	8-15	0.6-2.0	0.20-0.22	4.5-5.5	Low------------	0.37		
	15-36	<0.06	0.12-0.14	5.1-6.0	High-----------	0.28		
	36-70	0.2-0.6	0.18-0.20	5.6-6.6	High-----------	0.28		
269---------------- Humeston	0-14	0.2-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	4	7
	14-22	0.2-2.0	0.20-0.22	4.5-6.0	Moderate------	0.32		
	22-60	<0.06	0.13-0.15	4.5-6.5	High-----------	0.32		
276C2*:								
Ladoga-----------	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.32	5	6
	11-31	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	31-70	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		
Hedrick----------	0-7	0.6-2.0	0.21-0.23	5.6-7.3	Low------------	0.32	5	6
	7-25	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		
	25-60	0.6-2.0	0.18-0.20	5.6-7.8	Moderate------	0.43		
279---------------- Taintor	0-20	0.2-0.6	0.21-0.23	5.6-7.3	Moderate------	0.28	5	7
	20-46	0.2-0.6	0.14-0.18	5.6-6.5	High-----------	0.43		
	46-60	0.2-0.6	0.18-0.20	6.1-7.8	Moderate------	0.43		
280, 280B--------- Mahaska	0-23	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.28	5	7
	23-46	0.6-2.0	0.14-0.18	4.5-6.0	Moderate------	0.43		
	46-70	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
281B, 281C-------- Otley	0-16	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	5	7
	16-31	0.6-2.0	0.18-0.20	5.1-5.5	Moderate------	0.43		
	31-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
313E, 313E2, 313F------------- Gosport	0-7	0.2-0.6	0.18-0.20	5.1-7.3	Low------------	0.43	3-2	6
	7-27	<0.06	0.12-0.14	3.6-6.5	High-----------	0.32		
	27-72	<0.06	---	4.5-5.6	High-----------	---		
315*:								
Landes-----------	0-19	2.0-6.0	0.10-0.12	6.1-7.8	Low------------	0.20	5	3
	19-72	6.0-20	0.05-0.10	6.1-7.8	Low------------	0.20		
Perks------------	0-9	6.0-20	0.07-0.09	5.6-7.3	Low------------	0.15	5	1
	9-72	6.0-20	0.02-0.04	5.6-6.5	Very low------	0.15		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
315*:								
Nodaway	0-64	0.6-2.0	0.20-0.23	6.1-7.3	Moderate	0.37	5	7
362, 363	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	0.32	3	6
Haig	11-22	0.6-2.0	0.21-0.23	5.1-6.0	High	0.32		
	22-36	0.06-0.2	0.12-0.14	5.1-6.0	High	0.32		
	36-72	0.2-0.6	0.18-0.20	6.1-7.3	High	0.32		
364B	0-10	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	0.37	3-2	6
Grundy	10-19	0.2-0.6	0.18-0.20	5.1-6.5	High	0.37		
	19-28	0.06-0.2	0.11-0.13	5.1-7.3	High	0.37		
	28-86	0.06-0.2	0.18-0.20	5.6-7.3	High	0.37		
380B	0-23	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.32	5	7
Mahaska	23-46	0.6-2.0	0.14-0.18	5.1-6.0	Moderate	0.43		
	46-70	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.43		
424D2*, 424E*, 424E2*:								
Lindley	0-8	0.6-2.0	0.16-0.18	4.5-7.3	Low	0.32	5	6
	8-42	0.2-0.6	0.14-0.18	4.5-6.5	Moderate	0.32		
	42-79	0.2-0.6	0.12-0.16	6.1-7.8	Moderate	0.32		
Keswick	0-11	0.6-2.0	0.14-0.18	4.5-7.3	Moderate	0.37	3	6
	11-50	0.06-0.2	0.12-0.16	4.5-6.0	High	0.37		
	50-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate	0.37		
425D, 425D2	0-11	0.6-2.0	0.14-0.18	4.5-7.3	Moderate	0.37	3	6
Keswick	11-50	0.06-0.2	0.12-0.16	4.5-6.0	High	0.37		
	50-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate	0.37		
451D2	0-7	0.6-2.0	0.14-0.18	4.5-7.3	Low	0.28	5-4	6
Caleb	7-36	0.6-2.0	0.14-0.18	4.5-6.0	Moderate	0.28		
	36-72	0.6-6.0	0.12-0.16	6.1-6.5	Low	0.28		
453	0-18	0.6-2.0	0.19-0.23	5.1-7.3	Moderate	0.32	3	7
Tuskeego	18-49	<0.06	0.13-0.17	5.1-6.5	High	0.32		
	49-60	0.06-0.2	0.16-0.19	5.6-6.5	Moderate	0.32		
478G*:								
Gosport	0-7	0.2-0.6	0.14-0.16	5.1-7.3	Moderate	0.43	3-2	4
	7-27	<0.06	0.12-0.14	3.6-5.0	High	0.32		
	27-72	<0.06	---	4.5-5.0	High	---		
Rock outcrop.								
520	0-8	0.6-2.0	0.20-0.24	6.1-7.3	Moderate	0.32	5	7
Coppock	8-20	0.6-2.0	0.18-0.22	5.1-7.3	Moderate	0.43		
	20-45	0.6-2.0	0.17-0.21	4.5-6.0	Moderate	0.43		
	45-60	0.6-2.0	0.15-0.19	4.5-6.0	Moderate	0.43		
570C	0-12	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.32	5	7
Nira	12-30	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	0.43		
	30-60	0.6-2.0	0.18-0.20	5.6-6.5	Moderate	0.43		
581C2*:								
Otley	0-16	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.32	5	7
	16-31	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43		
	31-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.43		
Nira	0-12	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.32	5	7
	12-30	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	0.43		
	30-60	0.6-2.0	0.18-0.20	5.6-6.5	Moderate	0.43		
592C2, 592D2	0-8	0.6-2.0	0.22-0.24	4.5-7.3	Moderate	0.37	3-2	6
Mystic	8-51	0.06-0.2	0.15-0.19	4.5-6.5	High	0.37		
	51-65	0.6-2.0	0.16-0.18	6.1-6.5	Moderate	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
594C2, 594D2, 594E2----------- Galland	0-6	0.6-2.0	0.19-0.21	5.1-7.3	Moderate------	0.37	3	6
	6-38	0.06-0.2	0.14-0.19	4.5-6.0	High----------	0.37		
	38-60	0.6-6.0	0.11-0.13	5.1-6.5	Low-----------	0.24		
688-------------- Koszta	0-14	0.6-2.0	0.20-0.24	5.6-7.3	Moderate------	0.32	5	7
	14-60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate------	0.43		
715*: Nodaway----------	0-64	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Landes----------	0-19	2.0-6.0	0.10-0.12	6.1-7.8	Low-----------	0.20	5	3
	19-72	6.0-20	0.05-0.10	6.1-7.8	Low-----------	0.20		
730B*: Nodaway----------	0-64	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Cantril---------	0-17	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.32	5	6
	17-60	0.6-2.0	0.14-0.16	5.1-6.5	Moderate------	0.32		
731C2------------ Pershing	0-6	0.2-0.6	0.22-0.24	4.5-7.3	Moderate------	0.37	2	7
	6-32	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.37		
	32-72	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
732C2, 732D2----- Weller	0-6	0.2-0.6	0.22-0.24	4.5-7.3	High----------	0.43	2	7
	6-44	0.06-0.2	0.12-0.18	4.5-6.0	High----------	0.43		
	44-64	0.2-0.6	0.18-0.20	5.1-6.0	High----------	0.43		
779-------------- Kalona	0-15	0.2-0.6	0.18-0.20	5.6-7.3	High----------	0.28	5	7
	15-30	0.06-0.6	0.14-0.18	5.6-7.3	High----------	0.37		
	30-60	0.2-0.6	0.18-0.20	6.1-7.8	Moderate------	0.37		
792C2, 792D, 792D2----------- Armstrong	0-8	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.32	3-2	6
	8-44	0.06-0.2	0.11-0.16	5.1-6.5	High----------	0.32		
	44-68	0.2-0.6	0.14-0.16	5.1-8.4	Moderate------	0.32		
795D2------------ Ashgrove	0-5	0.2-0.6	0.20-0.22	4.5-7.3	Moderate------	0.43	3	7
	5-8	<0.06	0.12-0.14	5.1-7.3	High----------	0.32		
	8-68	<0.06	0.12-0.14	5.6-7.8	High----------	0.32		
831C2------------ Pershing	0-6	0.2-0.6	0.22-0.24	4.5-7.3	Moderate------	0.37	2	7
	6-32	0.06-0.2	0.18-0.20	5.1-7.3	High----------	0.37		
	32-72	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
832C2------------ Weller	0-6	0.2-0.6	0.22-0.24	4.5-7.3	High----------	0.43	2	7
	6-44	0.06-0.2	0.12-0.18	4.5-6.0	High----------	0.43		
	44-64	0.2-0.6	0.18-0.20	5.1-6.0	High----------	0.43		
876B, 876C, 876C2----------- Ladoga	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6
	11-31	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	31-70	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.43		
880B, 880C, 880C2----------- Clinton	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37	5	6
	11-34	0.2-0.6	0.16-0.20	5.1-6.0	Moderate------	0.37		
	34-86	0.6-2.0	0.18-0.20	6.1-6.5	Moderate------	0.37		
881B, 881C2------ Otley	0-16	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	5	7
	16-31	0.6-2.0	0.18-0.20	5.1-5.5	Moderate------	0.43		
	31-60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
892D2------------ Mystic Variant	0-7	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.43	2	7
	7-18	0.2-0.6	0.15-0.19	5.1-6.0	Moderate------	0.43		
	18-68	<0.06	0.14-0.16	5.1-7.3	High----------	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
977, 977B-------- Richwood	0-15	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	5
	15-40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate------	0.43		
	40-60	0.6-6.0	0.10-0.22	5.6-7.3	Low-----------	0.43		
993D2*:								
Gara------------	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.28	5	6
	11-40	0.2-0.6	0.16-0.18	4.5-6.5	Moderate------	0.28		
	40-60	0.2-0.6	0.16-0.18	6.6-7.8	Moderate------	0.37		
Armstrong-------	0-8	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.32	3-2	6
	8-44	0.06-0.2	0.11-0.16	5.1-6.5	High----------	0.32		
	44-68	0.2-0.6	0.14-0.16	5.1-6.5	Moderate------	0.32		
1075B------------ Givin	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.32	5	6
	11-32	0.2-0.6	0.18-0.20	5.1-5.5	Moderate------	0.43		
	32-60	0.2-0.6	0.18-0.20	5.1-5.5	Moderate------	0.43		
1130------------- Belinda	0-8	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	6
	8-16	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37		
	16-36	<0.06	0.12-0.14	4.5-5.5	High----------	0.28		
	36-75	0.06-0.6	0.18-0.20	5.1-6.0	High----------	0.28		
1131B------------ Pershing	0-9	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6
	9-32	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.37		
	32-72	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
1132B------------ Weller	0-16	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.28	5	6
	16-44	0.06-0.2	0.12-0.18	4.5-6.0	High----------	0.43		
	44-64	0.2-0.6	0.18-0.20	5.1-6.0	High----------	0.43		
1220------------- Nodaway	0-64	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
1279------------- Taintor	0-20	0.2-0.6	0.21-0.23	5.6-7.3	Moderate------	0.28	5	7
	20-46	0.06-0.6	0.14-0.18	5.6-6.5	High----------	0.43		
	46-60	0.2-0.6	0.18-0.20	6.1-7.8	Moderate------	0.43		
1280------------- Mahaska	0-23	0.6-2.0	0.21-0.23	5.1-7.3	Moderate------	0.32	5	7
	23-46	0.6-2.0	0.14-0.18	4.5-6.0	Moderate------	0.43		
	46-70	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
1315*:								
Landes----------	0-19	2.0-6.0	0.10-0.12	6.1-7.8	Low-----------	0.20	5	3
	19-72	6.0-20	0.05-0.10	6.1-7.8	Low-----------	0.20		
Perks-----------	0-9	6.0-20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1
	9-72	6.0-20	0.02-0.04	5.6-6.5	Very low------	0.15		
1977------------- Richwood Variant	0-22	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.32	---	5
	22-49	0.6-2.0	0.17-0.19	5.6-7.3	Low-----------	0.32		
	49-60	0.6-6.0	0.15-0.19	6.1-7.3	Low-----------	0.32		
4000*. Urban land								
5010*. Pits								
5020*. Pits-dumps complex								
5030*. Pits								
6313*. Orthents								

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[Terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
7------------------ Wiota	B	None---------	---	---	>6.0	---	---	High------	Moderate	Moderate.
11B*:										
Colo--------------	B/D	Frequent----	Very brief to brief.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
Ely---------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	High------	High------	Moderate.
13B*:										
Humeston----------	C	Frequent----	Brief------	Feb-Nov	0-1.0	Apparent	Nov-Jul	High------	High------	Moderate.
Vesser------------	C	Frequent----	Brief------	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
Colo--------------	B/D	Frequent----	Very brief to brief.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
23C, 23C2--------- Arispe	C	None---------	---	---	3.0-5.0	Apparent	Nov-Jul	High------	High------	Moderate.
41B, 41C, 41E----- Sparta	A	None---------	---	---	>6.0	---	---	Low-------	Low-------	Moderate.
51----------------- Vesser	C	Occasional	Brief------	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
54----------------- Zook	C/D	Frequent----	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
56B--------------- Cantril	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	High------	Moderate	Low.
58D2, 58E, 58E2, 58G--------------- Douds	B	None---------	---	---	4.0-6.0	Apparent	Nov-Jul	Moderate	Moderate	Moderate.
65E, 65E2, 65F, 65G--------------- Lindley	C	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
75B--------------- Givin	C	None---------	---	---	2.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
76B, 76C---------- Ladoga	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
80B, 80C, 80C2, 80D2-------------- Clinton	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
88----------------- Nevin	B	Rare---------	---	---	2.0-4.0	Apparent	Nov-Jul	High------	High------	Low.
93D2*:										
Shelby------------	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Adair-------------	D	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High------	High------	Moderate.
122---------------- Sperry	C/D	None---------	---	---	+.5-1.0	Apparent	Nov-Jul	High------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
130----------------- Belinda	D	None---------	---	---	0.5-2.0	Apparent	Nov-Jul	Moderate	High------	Moderate.
131B, 131C--------- Pershing	C	None---------	---	---	2.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
132B, 132C--------- Weller	C	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	High------	High------	High.
133, 133+---------- Colo	B/D	Frequent-----	Very brief to brief.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
173----------------- Hoopeston	B	None---------	---	---	1.0-3.0	Apparent	Nov-Jul	High------	Low-------	Moderate.
178----------------- Waukee	B	None---------	---	---	>6.0	---	---	Low-------	Low-------	Moderate.
179E, 179E2, 179F- Gara	C	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
192C2, 192D, 192D2------------- Adair	D	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High------	High------	Moderate.
208----------------- Landes	B	Frequent-----	Very brief to brief.	Feb-Nov	4.0-6.0	Apparent	Nov-Jul	Moderate	Low-------	Low.
211----------------- Edina	D	None---------	---	---	0.5-2.0	Apparent	Nov-Jul	Moderate	High------	Moderate.
220----------------- Nodaway	B	Frequent-----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High------	Moderate	Low.
222C, 222C2-------- Clarinda	D	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High------	High------	Moderate.
223C2, 223D2------- Rinda	D	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High------	High------	Moderate.
230C*:										
Arispe-------------	C	None---------	---	---	3.0-5.0	Apparent	Nov-Jul	High------	High------	Moderate.
Clearfield---------	C	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High------	High------	Low.
260----------------- Beckwith	D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	Moderate	High------	Moderate.
269----------------- Humeston	C	Occasional	Very brief to brief.	Feb-Nov	0-1.0	Apparent	Nov-Jul	High------	High------	Moderate.
276C2*:										
Ladoga-------------	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Hedrick------------	B	None---------	---	---	>6.0	---	---	High------	Moderate	Moderate.
279----------------- Taintor	C/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	High------	High------	Moderate.
280, 280B---------- Mahaska	B	None---------	---	---	2.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.
281B, 281C--------- Otley	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
313E, 313E2, 313F- Gosport	D	None---------	---	---	>6.0	---	---	Moderate	High------	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
315*:										
Landes	B	Frequent	Very brief to brief.	Feb-Nov	4.0-6.0	Apparent	Nov-Jul	Moderate	Low	Low.
Perks	A	Frequent	Very brief to brief.	Feb-Nov	>6.0	---	---	Low	Low	Moderate.
Nodaway	B	Frequent	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High	Moderate	Low.
362, 363 Haig	C/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	High	High	Moderate.
364B Grundy	C	None	---	---	1.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
380B Mahaska	B	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
424D2*, 424E*, 424E2*:										
Lindley	C	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Keswick	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
425D, 425D2 Keswick	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
451D2 Caleb	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	Moderate	Moderate	Moderate.
453 Tuskeego	C/D	Rare	---	---	0-1.0	Apparent	Nov-Jul	Moderate	High	Moderate.
478G*:										
Gosport	D	None	---	---	>6.0	---	---	Moderate	High	High.
Rock outcrop.										
520 Coppock	B	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
570C Nira	B	None	---	---	>6.0	---	---	High	Moderate	Moderate.
581C2*:										
Otley	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Nira	B	None	---	---	>6.0	---	---	High	Moderate	Moderate.
592C2, 592D2 Mystic	D	None	---	---	3.0-5.0	Perched	Nov-Jul	High	Moderate	Moderate.
594C2, 594D2, 594E2 Galland	D	None	---	---	3.0-5.0	Perched	Nov-Jul	High	High	Moderate.
688 Koszta	B	Rare	---	---	2.0-3.0	Apparent	Nov-Jul	High	Moderate	Moderate.
715*:										
Nodaway	B	Frequent	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High	Moderate	Low.
Landes	B	Frequent	Very brief to brief.	Feb-Nov	4.0-6.0	Apparent	Nov-Jul	Moderate	Low	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
730B*:										
Nodaway	B	Frequent	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High	Moderate	Low.
Cantril	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jul	High	Moderate	Low.
731C2 Pershing	C	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
732C2, 732D2 Weller	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	High	High	High.
779 Kalona	C	None	---	---	1.0-2.0	Apparent	Nov-Jul	High	High	Moderate.
792C2, 792D, 792D2 Armstrong	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
795D2 Ashgrove	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
831C2 Pershing	C	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
832C2 Weller	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	High	High	High.
876B, 876C, 876C2 Ladoga	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
880B, 880C, 880C2 Clinton	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
881B, 881C2 Otley	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
892D2 Mystic Variant	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
977, 977B Richwood	B	None	---	---	>6.0	---	---	High	Moderate	Moderate.
993D2*:										
Gara	C	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Armstrong	D	None	---	---	1.0-3.0	Perched	Nov-Jul	High	High	Moderate.
1075B Givin	C	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
1130 Belinda	D	None	---	---	0.5-2.0	Apparent	Nov-Jul	Moderate	High	Moderate.
1131B Pershing	C	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.
1132B Weller	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	High	High	High.
1220 Nodaway	B	Frequent	Very brief to long.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High	Moderate	Low.
1279 Taintor	C/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	High	High	Moderate.
1280 Mahaska	B	None	---	---	2.0-3.0	Apparent	Nov-Jul	High	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
1315*:										
Landes-----------	B	Frequent----	Very brief to long.	Feb-Nov	4.0-6.0	Apparent	Nov-Jul	Moderate	Low------	Low.
Perks------------	A	Frequent----	Very brief to long.	Feb-Nov	>6.0	---	---	Low------	Low------	Moderate.
1977--------------- Richwood Variant	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
4000*. Urban land										
5010*. Pits										
5020*. Pits-dumps complex										
5030*. Pits										
6313*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adair	Fine, montmorillonitic, mesic Aquic Argiudolls
Arispe	Fine, montmorillonitic, mesic Aquic Argiudolls
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Ashgrove	Fine, montmorillonitic, mesic, sloping Aeric Ochraqualfs
Beckwith	Fine, montmorillonitic, mesic Typic Albaqualfs
Belinda	Fine, montmorillonitic, mesic Mollic Albaqualfs
Caleb	Fine-loamy, mixed, mesic Mollic Hapludalfs
Cantril	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Clearfield	Fine, montmorillonitic, mesic, sloping Typic Haplaquolls
Clinton	Fine, montmorillonitic, mesic Typic Hapludalfs
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Douds	Fine-loamy, mixed, mesic Typic Hapludalfs
Edina	Fine, montmorillonitic, mesic Typic Argialbolls
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Galland	Fine, montmorillonitic, mesic Aquic Hapludalfs
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Givin	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Gosport	Fine, illitic, mesic Typic Dystrochrepts
Grundy	Fine, montmorillonitic, mesic Aquic Argiudolls
Haig	Fine, montmorillonitic, mesic Typic Argiaquolls
Hedrick	Fine-silty, mixed, mesic Mollic Hapludalfs
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Humeston	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Kalona	Fine, montmorillonitic, mesic Typic Haplaquolls
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
Koszta	Fine-silty, mixed, mesic Udollic Ochraqualfs
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Mahaska	Fine, montmorillonitic, mesic Aquic Argiudolls
Mystic	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Mystic Variant	Fine, montmorillonitic, mesic, sloping Mollic Ochraqualfs
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nira	Fine-silty, mixed, mesic Typic Hapludolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Orthents	Fine, montmorillonitic, mesic Typic Udorthents
Otley	Fine, montmorillonitic, mesic Typic Argiudolls
Perks	Mixed, mesic Typic Udipsamments
Pershing	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Richwood	Fine-silty, mixed, mesic Typic Argiudolls
Richwood Variant	Fine loamy, mixed, mesic Typic Argiudolls
Rinda	Fine, montmorillonitic, mesic, sloping Mollic Ochraqualfs
*Shelby	Fine-loamy, mixed, mesic Typic Argiudolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Sperry	Fine, montmorillonitic, mesic Typic Argialbolls
Taintor	Fine, montmorillonitic, mesic Typic Argiaquolls
Tuskeego	Fine, montmorillonitic, mesic Mollic Ochraqualfs
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs
Wiota	Fine-silty, mixed, mesic Typic Argiudolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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