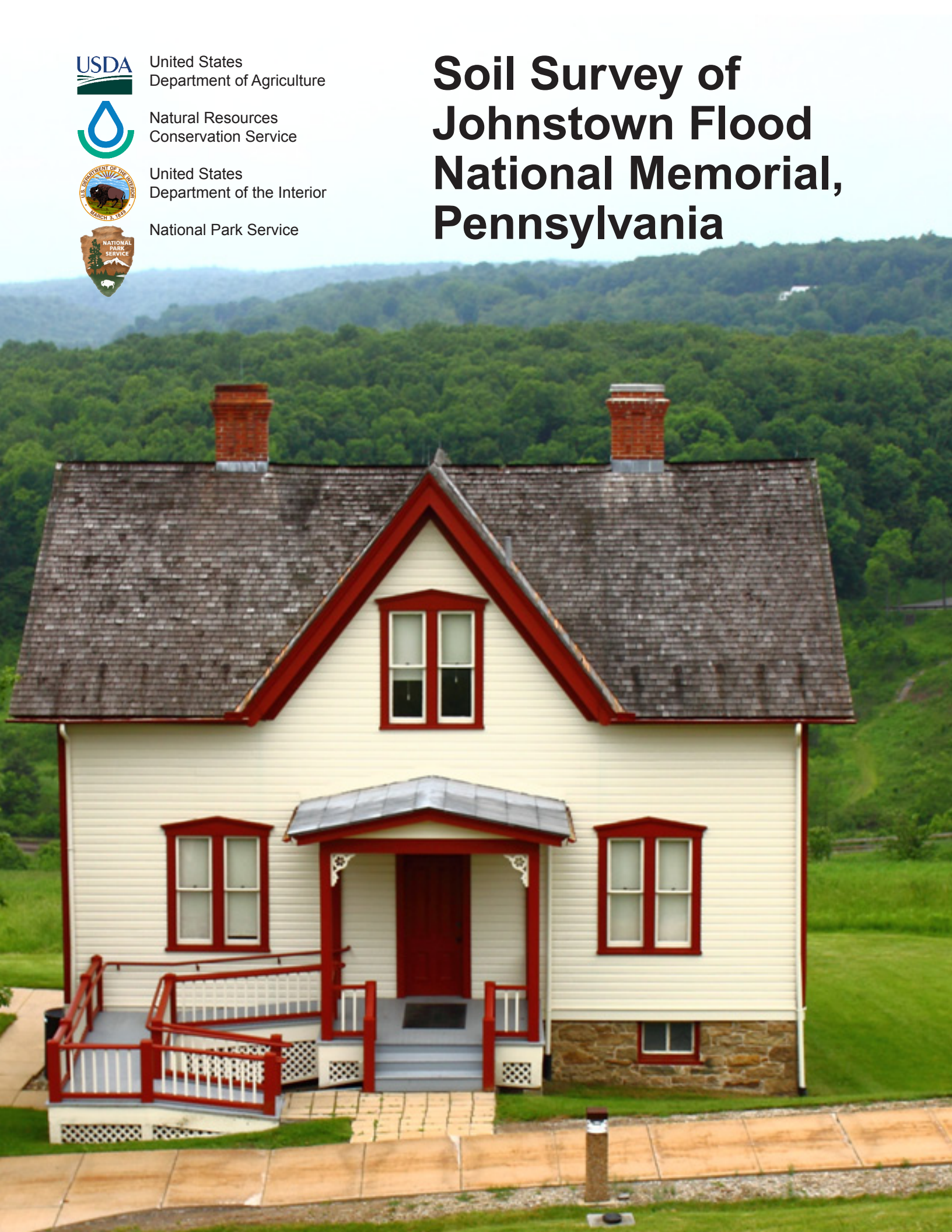
United States
Department of Agriculture

Natural Resources
Conservation Service

United States
Department of the Interior

National Park Service

Soil Survey of Johnstown Flood National Memorial, Pennsylvania



How To Use This Soil Survey

This publication consists of text, tables, and a map. The text includes descriptions of detailed soil map units and provides an explanation of the information presented in the tables. It also includes a glossary of terms used in the text and tables and a list of references.

The detailed soil map can be useful in planning the use and management of small areas. To find information about your area of interest, locate that area on the map sheet. Note the map unit symbols that are in that area. Go to the Contents, which lists the map units by symbol and name and shows where each map unit is described.

The Contents shows which table has data on a specific land use for each detailed soil map unit. Also see the Contents for sections of this publication that may address your specific needs.

National Cooperative Soil Survey

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 Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

The soil map in this survey may be copied without permission. Enlargement of this map, however, could cause misunderstanding of the detail of mapping. If enlarged, the map does not show the small areas of contrasting soils that could have been shown at a larger scale.

Literature Citation

The correct citation for this survey is as follows:

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Cover Caption

The house used for NPS employee offices is located near the Johnstown Flood National Memorial dam site, on Cavode silt loam, 8 to 15 percent slopes. Visible to the right of the house are remnants of the South Fork dam. The steep hillslopes in the background are mapped as Laidig soils, 25 to 70 percent slopes.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov/.

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Preface

This soil survey was developed in conjunction with the National Park Service's Soil Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Johnstown Flood National Memorial, Pennsylvania.

This soil survey contains information that affects current and future land use planning in the park. It contains predictions of soil behavior for selected land uses. The survey highlights soil limitations, actions needed to overcome the limitations, and the impact of selected land uses on the environment. It is designed to meet the needs of the National Park Service and its partners to better understand the properties of the soils in the park and the effects of these properties on various natural ecological characteristics. This knowledge can help the National Park Service and its partners to understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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. The location of each map unit is shown on the detailed soil map. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the park office for Johnstown Flood National Memorial, Pennsylvania.

Soil Survey of
Johnstown Flood National Memorial, Pennsylvania

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service

How This Survey Was Made

This survey was made in conjunction with the National Park Service's Soil Inventory and Monitoring Program to provide information about the soils and miscellaneous areas within Johnstown Flood National Memorial.

The soil survey data was extracted from the county-based soil survey of Cambria County, Pennsylvania. The Cambria County soil survey was correlated in May 1978 and recertified in 2003. Quality assurance of the data was conducted by the NRCS Morgantown MLRA office. The original fieldwork was conducted at a scale of 1:20,000. At the time when this data was extracted in 2012, there were 14 soil map units within the park and 39 map unit components.

The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they delineated the boundaries of these bodies on digital imagery and identified each as a specific map unit.

Detailed Soil Map Units

The map units delineated on the detailed soil map in this survey represent the soils or miscellaneous areas in the park. The map unit descriptions in this section, along with the map, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the map. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. The soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, 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 map are phases of soil series. The name of a soil

phase commonly indicates a feature that affects use or management. For example, Armagh silt loam, 0 to 8 percent slopes, is a phase of the Armagh series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the map. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Cookport and Ernest soils, 3 to 8 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Water is an example.

For some map units, component percentages do not add up to 100 percent due to the vintage of the data. In older soil surveys, components of minor extent were not assigned a component percentage.

Table 1 lists each map unit in the park, its major and minor components, and the percentage of each component in the unit. Other 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 or miscellaneous areas.

541887—Armagh silt loam, 0 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Mean annual precipitation: 35 to 51 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 115 to 165 days

Map Unit Composition

Armagh and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Armagh Soil

Taxonomic Classification
Clayey, mixed, active, mesic Typic Endoaquults

Setting
Landform: Depressions
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Slope range: 0 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Very high
Parent material: Residuum weathered from shale
Restrictive feature(s): Paralithic bedrock at a depth of 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: At the soil surface to 6 inches

Drainage class: Poorly drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.9 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4w
Meets hydric soil criteria: Yes
Hydrologic soil group: D

Typical Profile
0 to 12 inches; silt loam
12 to 48 inches; silty clay loam
48 to 60 inches; very channery silty clay loam

Minor Components

Cavode soils
Percent of map unit: 10 percent
Landform: Hills
Geomorphic position (two-dimensional): Summit
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Meets hydric soil criteria: No

Armagh, very stony soils
Percent of map unit: 5 percent
Landform: Depressions on hills
Geomorphic position (two-dimensional): Summit
Geomorphic position (three-dimensional): Interfluve
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 3 to 8 percent
Down-slope shape: Concave
Across-slope shape: Linear
Meets hydric soil criteria: Yes

541888—Atkins silt loam

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 400 to 2,995 feet
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Atkins and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Atkins Soil

Taxonomic Classification
Fine-loamy, mixed, active, acid, mesic Fluvaquentic Endoaquepts

Setting
Landform: Flood plains
Landform position (three-dimensional): Base slope
Slope range: 0 to 3 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Very high
Restrictive feature(s): Lithic bedrock at a depth of 60 to 99 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Depth to water table: At the soil surface to 12 inches
Drainage class: Poorly drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: High (about 9.5 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3w
Meets hydric soil criteria: Yes
Hydrologic soil group: B/D

Typical Profile
0 to 9 inches; silt loam
9 to 36 inches; silt loam
36 to 64 inches; stratified gravelly sandy loam to silty clay loam

Minor Components

Basher soils
Percent of map unit: 5 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 3 percent
Meets hydric soil criteria: No

Elkins soils
Percent of map unit: 5 percent
Landform: Flood plains
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 0 to 3 percent
Down-slope shape: Concave
Across-slope shape: Linear
Meets hydric soil criteria: Yes

Philo soils
Percent of map unit: 5 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 3 percent
Meets hydric soil criteria: No

541889—Berks channery silt loam, 3 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 2,995 feet
Mean annual precipitation: 30 to 65 inches
Mean annual air temperature: 45 to 59 degrees F
Frost-free period: 120 to 214 days

Map Unit Composition

Berks and similar soils: 85 percent
Dissimilar minor components: 10 percent

Description of the Berks Soil

Taxonomic Classification
Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Setting
Landform: Shale hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Slope range: 3 to 8 percent
Down-slope shape: Convex and linear
Across-slope shape: Linear and convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Low
Parent material: Acid silty residuum weathered from shale and siltstone
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 2.6 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 7 inches; channery silt loam
7 to 29 inches; very channery silt loam
29 to 34 inches; extremely channery silt loam
34 to 38 inches; bedrock

Minor Components

Bedington soils
Percent of map unit: 3 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 8 to 15 percent
Meets hydric soil criteria: No

Ernest soils
Percent of map unit: 3 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Meets hydric soil criteria: No

Blairton soils
Percent of map unit: 2 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Meets hydric soil criteria: No

Weikert soils
Percent of map unit: 2 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 8 to 15 percent
Meets hydric soil criteria: No

541892—Blairton silt loam, 3 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 1,295 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 214 days

Map Unit Composition

Blairton and similar soils: 90 percent
Dissimilar minor components: 5 percent

Description of the Blairton Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Aquic Hapludults

Setting
Landform: Depressions
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Head slope
Slope range: 3 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Local silty colluvium derived from shale and siltstone over acid silty residuum weathered from shale and siltstone
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 6 to 36 inches, perched (see table 19)
Drainage class: Somewhat poorly drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 3.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3w
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 9 inches; silt loam
9 to 22 inches; channery silty clay loam
22 to 26 inches; very channery loam
26 to 30 inches; bedrock

Minor Components

Brinkerton soils
Percent of map unit: 5 percent
Landform: Hills
Geomorphic position (two-dimensional): Footslope
Geomorphic position (three-dimensional): Base slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

541896—Brinkerton silt loam, 0 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 2,995 feet
Mean annual precipitation: 30 to 65 inches

Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days

Map Unit Composition

Brinkerton and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of the Brinkerton Soil

Taxonomic Classification

Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs

Setting

Landform: Depressions
Slope range: 0 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities

Runoff: Very high
Parent material: Colluvium derived from shale and siltstone
Restrictive feature(s): A fragipan at a depth of 28 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): At the soil surface to 6 inches, perched (see table 19)
Drainage class: Poorly drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: High (about 9.1 inches)

Interpretive Groups

Land capability subclass (nonirrigated): 4w
Meets hydric soil criteria: Yes
Hydrologic soil group: D

Typical Profile

0 to 7 inches; silt loam
7 to 28 inches; silty clay loam
28 to 41 inches; channery silty clay loam
41 to 60 inches; channery silt loam

Minor Components

Ernest soils

Percent of map unit: 10 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 8 percent
Meets hydric soil criteria: No

541900—Cavode silt loam, 8 to 15 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 1,000 to 1,695 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 160 days

Map Unit Composition

Cavode and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Cavode Soil

Taxonomic Classification
Fine, mixed, active, mesic Aeric Endoaquults

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (two-dimensional): Summit and backslope
Landform position (three-dimensional): Side slope
Slope range: 8 to 15 percent
Down-slope shape: Linear and concave
Across-slope shape: Concave
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Very high
Parent material: Acid clayey residuum weathered from clayey shale
Restrictive feature(s): Lithic bedrock at a depth of 40 to 90 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 6 to 18 inches, perched (see table 19)
Drainage class: Somewhat poorly drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C/D

Typical Profile
Ap—0 to 10 inches; silt loam
Btg—10 to 47 inches; silty clay loam
BCg—47 to 57 inches; channery silt loam
R—57 to 61 inches; bedrock

Minor Components

Gilpin soils
Percent of map unit: 10 percent
Landform: Hillslopes
Geomorphic position (two-dimensional): Summit, shoulder, and backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 8 to 15 percent
Down-slope shape: Convex
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Brinkerton soils
Percent of map unit: 5 percent
Landform: Hills and draws
Geomorphic position (two-dimensional): Footslope and toeslope
Geomorphic position (three-dimensional): Base slope and head slope
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 3 to 8 percent
Down-slope shape: Linear and concave
Across-slope shape: Linear and concave
Meets hydric soil criteria: Yes

541903—Cookport and Ernest soils, 3 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 2,995 feet
Mean annual precipitation: 30 to 65 inches
Mean annual air temperature: 45 to 59 degrees F
Frost-free period: 110 to 214 days

Map Unit Composition

Cookport and similar soils: 65 percent
Ernest and similar soils: 25 percent
Dissimilar minor components: 10 percent

Description of the Cookport Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Slope range: 3 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Residuum weathered from acid sandstone
Restrictive feature(s): A fragipan at a depth of 26 inches; lithic bedrock at a depth of 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 18 to 30 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 14 inches; channery loam
14 to 26 inches; channery loam
26 to 40 inches; channery loam
40 to 60 inches; channery sandy loam
60 to 62 inches; bedrock

Description of the Ernest Soil

Taxonomic Classification
Fine-loamy, mixed, superactive, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Slope range: 3 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Medium
Parent material: Colluvium derived from shale and siltstone
Restrictive feature(s): A fragipan at a depth of 17 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 4 to 20 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 8 inches; silt loam
8 to 26 inches; silty clay loam
26 to 41 inches; channery silt loam
41 to 61 inches; channery silt loam

Minor Components

Brinkerton soils
Percent of map unit: 10 percent
Landform: Depressions
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 0 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

541904—Cookport and Ernest soils, 8 to 15 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 2,995 feet
Mean annual precipitation: 30 to 65 inches
Mean annual air temperature: 45 to 59 degrees F
Frost-free period: 110 to 214 days

Map Unit Composition

Cookport and similar soils: 70 percent
Ernest and similar soils: 25 percent
Dissimilar minor components: 5 percent

Description of the Cookport Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountaintop
Slope range: 8 to 15 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Residuum weathered from acid sandstone

Restrictive feature(s): A fragipan at a depth of 26 inches; lithic bedrock at a depth of 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 18 to 30 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 14 inches; channery loam
14 to 26 inches; channery loam
26 to 40 inches; channery loam
40 to 60 inches; channery sandy loam
60 to 62 inches; bedrock

Description of the Ernest Soil

Taxonomic Classification
Fine-loamy, mixed, superactive, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Slope range: 8 to 15 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Medium
Parent material: Colluvium derived from shale and siltstone
Restrictive feature(s): A fragipan at a depth of 17 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 4 to 20 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 8 inches; silt loam
8 to 26 inches; silty clay loam
26 to 41 inches; channery silt loam
41 to 61 inches; channery silt loam

Minor Components

Brinkerton soils
Percent of map unit: 5 percent
Landform: Depressions
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 0 to 8 percent
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

541907—Cookport and Ernest very stony soils, 8 to 25 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 475 to 2,995 feet
Mean annual precipitation: 30 to 65 inches
Mean annual air temperature: 34 to 59 degrees F
Frost-free period: 110 to 180 days

Map Unit Composition

Cookport and similar soils: 70 percent
Ernest and similar soils: 25 percent
Dissimilar minor components: 5 percent

Description of the Cookport Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountaintop
Slope range: 8 to 25 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Colluvium weathered from sandstone and siltstone
Restrictive feature(s): A fragipan at a depth of 26 inches; lithic bedrock at a depth of 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None

Water table (depth, kind): At the soil surface to 6 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 10 inches; channery loam
10 to 26 inches; channery loam
26 to 40 inches; channery loam
40 to 60 inches; channery sandy loam
60 to 62 inches; bedrock

Description of the Ernest Soil

Taxonomic Classification
Fine-loamy, mixed, superactive, mesic Aquic Fragiudults

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Slope range: 8 to 25 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Medium
Parent material: Colluvium derived from shale and siltstone
Restrictive feature(s): A fragipan at a depth of 17 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 4 to 20 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 8 inches; channery silt loam
8 to 26 inches; silty clay loam

26 to 41 inches; channery silt loam
41 to 61 inches; channery silt loam

Minor Components

Brinkerton soils
Percent of map unit: 5 percent
Landform: Depressions
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Meets hydric soil criteria: Yes

541915—Gilpin-Rayne silt loams, 15 to 25 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Mean annual precipitation: 37 to 65 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 110 to 180 days

Map Unit Composition

Gilpin and similar soils: 70 percent
Rayne and similar soils: 30 percent

Description of the Gilpin Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Typic Hapludults

Setting
Landform: Hillslopes
Landform position (two-dimensional): Shoulder and backslope
Slope range: 15 to 25 percent
Down-slope shape: Linear and convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Residuum weathered from interbedded sedimentary rock
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline

Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 5.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 10 inches; silt loam
10 to 28 inches; channery silty clay loam
28 to 38 inches; very channery silt loam
38 to 42 inches; bedrock

Description of the Rayne Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Typic Hapludults

Setting
Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Slope range: 15 to 25 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Residuum weathered from interbedded sedimentary rock
Restrictive feature(s): Lithic bedrock at a depth of 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.3 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: B

Typical Profile
0 to 8 inches; silt loam
8 to 40 inches; channery silty clay loam
40 to 60 inches; very channery silty clay loam
60 to 64 inches; bedrock

541925—Laidig soils, 25 to 70 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 400 to 3,795 feet
Mean annual precipitation: 34 to 60 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 120 to 175 days

Map Unit Composition

Laidig and similar soils: 100 percent

Description of the Laidig Soil

Taxonomic Classification
Fine-loamy, siliceous, mesic Typic Fragiudults

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainbase
Slope range: 25 to 70 percent
Down-slope shape: Concave
Across-slope shape: Concave
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Mountain slope fine-loamy colluvium derived from interbedded sedimentary rock
Restrictive feature(s): A fragipan at a depth of 30 to 50 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 28 to 36 inches, perched (see table 19)
Drainage class: Well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 6.1 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 7e
Meets hydric soil criteria: No
Hydrologic soil group: C

Typical Profile
0 to 7 inches; channery loam
7 to 36 inches; channery loam
36 to 50 inches; very channery sandy loam
50 to 65 inches; channery sandy loam

541933—Philo silt loam

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 520 to 1,600 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days

Map Unit Composition

Philo and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of the Philo Soil

Taxonomic Classification
Coarse-loamy, mixed, active, mesic Fluvaquentic Dystrudepts

Setting
Landform: Flood plains
Slope range: 0 to 2 percent
Down-slope shape: Linear and concave
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: Low
Parent material: Recent coarse-loamy alluvium derived from sandstone and shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: About 18 to 24 inches (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation
Existing plants: Red maple, American hornbeam, sedge, white ash, and sword fern

Typical Profile
Ap—0 to 10 inches; silt loam
Bw—10 to 40 inches; silt loam
2C—40 to 65 inches; gravelly sandy loam

Minor Components

Atkins soils
Percent of map unit: 10 percent
Landform: Flood plains
Representative aspect: Southeast
Aspect range: All aspects
Slope range: 0 to 2 percent
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

541941—Urban land-Udorthents complex, sloping

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 200 to 1,295 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 43 to 55 degrees F
Frost-free period: 100 to 214 days

Map Unit Composition

Urban land: 60 percent
Udorthents and similar soils: 30 percent
Dissimilar minor components: 1 percent

Description of Urban Land

Urban land consists of residential, industrial, commercial, and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water-control structures and spillways; other land used for such purposes; small (less than 10 acres) parks within urban and built-up areas; and highways, railroads, and other transportation facilities, if they are surrounded by urban areas.

Description of the Udorthents

Taxonomic Classification
Udorthents

Setting
Slope range: 8 to 15 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects

Properties and Qualities
Parent material: Manmade and altered materials from mixed rock types
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 1.8 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
Meets hydric soil criteria: No
Hydrologic soil group: A

Typical Profile
0 to 6 inches; very channery silt loam
6 to 60 inches; very channery silt loam

Minor Components

Wet spots
Percent of map unit: 1 percent
Landform: Depressions
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 8 percent
Meets hydric soil criteria: Yes

541942—Water

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F

Map Unit Composition

Water: 100 percent

Description of Water

This map unit consists of small streams and ponds and the South Fork of the Little Conemaugh River.

541943—Wharton silt loam, 3 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 127—Eastern Allegheny Plateau and Mountains
Elevation: 295 to 2,400 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 214 days

Map Unit Composition

Wharton and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Wharton Soil

Taxonomic Classification
Fine-loamy, mixed, active, mesic Aquic Hapludults

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, side slope, and interfluve
Slope range: 3 to 8 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: Southeast
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic

Properties and Qualities
Runoff: High
Parent material: Fine-loamy residuum weathered from shale and siltstone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 70 inches
Frequency of flooding: None
Frequency of ponding: None
Water table (depth, kind): About 18 to 36 inches, perched (see table 19)
Drainage class: Moderately well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: C/D

Typical Profile
0 to 7 inches; silt loam
7 to 44 inches; channery silty clay loam
44 to 60 inches; very channery silty clay loam
60 to 70 inches; bedrock

Minor Components

Cavode soils
Percent of map unit: 8 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Meets hydric soil criteria: No

Buchanan soils
Percent of map unit: 5 percent
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 8 percent
Meets hydric soil criteria: No

Hartleton soils
Percent of map unit: 5 percent
Geomorphic position (two-dimensional): Shoulder and backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: South

Aspect range: All aspects
Slope range: 3 to 8 percent
Down-slope shape: Linear and concave
Across-slope shape: Linear and concave
Meets hydric soil criteria: No

Brinkerton soils
Percent of map unit: 2 percent
Landform: Sloughs
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 6 percent
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils within Johnstown Flood National Memorial, Pennsylvania. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent 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 behavioral 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 as farmland and as sites for buildings, sanitary facilities, highways and other transportation systems, and recreational facilities. 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 park. 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, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the park for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, slightly limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately well suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact

on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

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 criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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 rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA-SCS, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

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, 2e. The letter *e* shows that the main hazard is the 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 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

The capability classification of map units in this park is given in the section “Detailed Soil Map Units” and in table 2.

Prime and Other Important Farmland

Table 3 lists the map units in the park that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some soils identified as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield

as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber, forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Hydric Soils

Table 4 lists the map unit components that are rated as hydric soils in the park. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; USDA-NRCS, 2010).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin et al., 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in “Soil Taxonomy” (Soil Survey Staff, 1999) and “Keys to Soil Taxonomy” (Soil Survey Staff, 2010) and in the “Soil Survey Manual” (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in “Field Indicators of Hydric Soils in the United States” (USDA-NRCS, 2010).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2B3). Definitions for the codes are as follows:

1. All Histels except for Folistels and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2) a water table at a depth of 0.5 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3) a water table at a depth of 1.0 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Landform and Parent Material

Table 5 displays information about climate, landform, and parent material for each soil in the map units.

Percent of the map unit is the extent of the named soil in the map unit.

Slope is 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. The table shows the low and high range of slope for the named component or soil.

MAP is the mean annual precipitation for areas of the soil in the map unit.

Landform is a specific shape of the earth in the area where a soil typically occurs. Examples are a mountain summit and a valley bottom.

Parent material is the material in which soils formed. Examples are the underlying geological material (including bedrock), a surficial deposit (such as volcanic ash), and organic material. Soils inherit their chemical and physical properties from the parent material.

Land Management

In table 6, parts I through IV, interpretive ratings are given for various aspects of land management. The ratings are both verbal and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified land management practice. *Well suited* indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified land management practice (1.00) and the point at which the soil feature is not a limitation (0.00).

Rating class terms for *fire damage* and *seedling mortality* are expressed as low, moderate, and high. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for fire damage or seedling mortality is highest (1.00) and the point at which the potential is lowest (0.00).

Rating class terms for *hazard of erosion* are expressed as slight, moderate, severe, and very severe. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for erosion is highest (1.00) and the point at which the potential is lowest (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils for land management practices.

Planting

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, poorly suited, or unsuited to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *soil rutting hazard* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of planting equipment. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

Hazard of Erosion and Suitability for Roads

Ratings in the column *hazard of erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in areas where 50 to 75 percent of the surface has been exposed by different kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface)* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Site Preparation

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Site Restoration

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Recreation

The soils of the park are rated in table 7, parts I and II, according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the table 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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, and water management.

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 ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Foot traffic and equestrian trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain bike and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, depth to a water table, ponding, slope, flooding, and texture of the surface layer.

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. Ratings are given for building site development, landscaping, 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 between the surface and a depth of 5 to 7 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 should 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 particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, 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 kinds 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 evaluate the potential of areas for residential, commercial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for septic tank absorption fields and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, ponds, and other structures for soil and water conservation; and 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 map, 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.

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 8 shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties

that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Roads and Streets, Shallow Excavations, and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 9 shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on

the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Landscaping requires soils on which turf, trees, and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sewage Disposal

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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 or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

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. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (K_{sat}) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a K_{sat} rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, 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. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Source of Gravel and Sand

Table 11 gives information about the soils as potential sources of gravel and sand. Normal compaction, minor processing, and other standard construction practices are assumed.

Gravel and *sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. Only the likelihood of finding material in suitable quantity is evaluated. 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 Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet.

The soils are rated *good, fair,* or *poor* as potential sources of sand and gravel. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

Source of Reclamation Material, Roadfill, and Topsoil

Table 12 gives information about the soils as potential sources of reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good, fair,* or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the table. Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not

apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

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 whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a 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 AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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.

Ponds and Embankments

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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 saturated hydraulic conductivity (K_{sat}) 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. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings 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, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, K_{sat} of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained 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 map. Samples are taken from some typical profiles and tested in the laboratory to determine particle-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 to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering properties, physical and chemical properties, and pertinent soil and water features.

Engineering Properties

Table 14 gives the engineering classifications and the range of engineering properties for the layers of each soil in the park.

Depth to the upper and lower boundaries of each layer is indicated.

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 the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.”

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-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, CL-ML.

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 particle-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 10 inches in diameter and 3 to 10 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 ovendry 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.

Physical Soil Properties

Table 15 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the park. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (K_{sat}), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$- or $^1/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water

and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, 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 and septic tank absorption fields.

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 soil layer. The capacity varies, depending on soil properties that affect retention of water. 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.

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 the basis of 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 classes are *low,* a change of less than 3 percent; *moderate,* 3 to 6 percent; *high,* 6 to 9 percent; and *very high,* greater than 9 percent.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion Properties

Table 16 shows estimates of some erosion factors that affect a soil's potential for different uses. These estimates are given for each layer of every soil for K factors and are given as one rating for the entire soil for the T factor, the wind erodibility group, and the wind erodibility index. Values are reported for each soil in the park. Estimates are based on field observations and on test data for these and similar soils.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Soil erosion factors Kw and Kf quantify soil detachment by runoff and raindrop impact. These erosion factors are indexes used to predict the long-term average soil loss from sheet and rill erosion under crop systems and conservation techniques. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) 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 and on soil structure and K_{sat}. Values

of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The procedure for determining the Kf factor is outlined in Agriculture Handbook 703, "Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE)," USDA, Agricultural Research Service, 1997.

Depth to the upper and lower boundaries of each layer is indicated.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments. In horizons where total rock fragments are 15 percent or more, by volume, the Kw factor is always less than the Kf factor.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. Soil horizons that do not have rock fragments are assigned equal Kw and Kf factors.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/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 susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Total Soil Carbon

Table 17 gives estimates of total soil carbon. Soil carbon occurs as organic and inorganic carbon.

Soil organic carbon (SOC) is carbon (C) in soil that originated from a biological source, such as plants, animals, or micro-organisms. SOC is found in both organic and mineral soil layers. The term "soil organic carbon" refers only to the carbon occurring in soil organic matter (SOM). Soil organic carbon makes up about one-half the weight of soil organic matter. The rest of SOM is mostly oxygen, nitrogen, and hydrogen.

Soil inorganic carbon (SIC) is carbon found in soil carbonates, typically as calcium carbonate layers in the soil or as clay-sized fractions throughout the soil. Carbonates in soils are most common in areas where evaporation rates exceed precipitation, as is the case in most desert environments. Typically, the carbonates accumulated from carbonatic dust or from solution during periods of wetter climates. Soil inorganic carbon also occurs in soils that formed in marl in all regions of the country.

The SOC and SIC contents are reported in kilograms per square meter to a depth of 2 meters or to a representative depth of either hard bedrock or a cemented horizon. The SOC and SIC values are on a whole soil basis, corrected for rock fragments.

SOC can be an indicator of overall soil fertility and soil quality that affects ecosystem function. SOM is the main reservoir for most plant nutrients, such as phosphorus and nitrogen. Managing for SOC by managing for SOM increases the content of these elements and improves soil resiliency.

Soil organic matter binds soil particles together and thus increases soil porosity and water infiltration and allows better root penetration and waterflow into the soil. Greater inflow of water reduces the hazard of erosion and the rate of surface water runoff.

Greater SOC levels improve not only soil quality but also the quality of air and water. Soil acts as a filter and improves water quality. Fertile soils that support plant life remove CO_2 from the atmosphere and increase oxygen levels through photosynthesis. Maintaining the level of soil organic carbon reduces C release into the atmosphere and thus can lessen the effects of global warming.

SIC influences the types of plants that will grow. High SIC levels are commonly associated with a higher soil pH, which limits the types of plants that will thrive.

Like SOM, soil carbonates, the source of SIC, also bind soil particles together. They fill voids in the soil and thus can reduce soil porosity. Compacted soil carbonates may restrict root penetration and waterflow into the soil.

Chemical Soil Properties

Table 18 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the park. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable 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. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil 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.

Water Features

Table 19 gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 19 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

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 little or no horizon development.

Also considered are 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.

Soil Features

Table 20 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the thickness and hardness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for 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, saturated hydraulic conductivity (K_{sat}), 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 the 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 to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes 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 results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete 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 also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Formation and Classification of the Soils

This section relates the soils in Johnstown Flood National Memorial to the major factors of soil formation and describes the system of soil classification.

Factors of Soil Formation

By Susan Burlew Southard, Natural Resources Conservation Service.

Soil covers the surface of the earth as a three-dimensional body of varying thickness and is made up of different proportions of organic and mineral material, pore space with gases, and water. Soils differ in their appearance, productivity, and management requirements due to their chemical and physical properties. The characteristics and properties of soils are determined by physical and chemical processes that result from the interaction of five soil-forming factors. These factors of soil formation are interdependent, and few generalizations can be made regarding any one factor unless the effects of the other factors are known. The term “pedogenesis” is often used to connote the processes of soil formation.

The interacting soil-forming factors are parent material, climate, organisms, time, and relief or topography (Jenny, 1941). *Parent material* is the source material in which soils formed. Soils are influenced by the texture and structure of the parent material and its mineralogical and chemical composition. *Climate* is predominantly the temperature and kind and amount of precipitation. It is also seasonal distribution of temperature and precipitation. *Organisms* are the plants and other organisms living in and on the soil, including humans. *Time* refers to how long the soil-forming factors have been operating on a particular landscape. *Relief* or *topography* is the shape and elevation of the landscape. It affects internal and external soil properties, such as soil drainage, aeration, susceptibility to erosion, and the soil’s exposure to the sun and wind.

The processes of soil formation are a sequence of events, involving biogeochemical reactions that are energized by climate and spatially related to relief or topography (Buol et al., 2011). The physical and chemical properties of a soil are altered by these reactions over time. The influence of any one of these factors varies among all parks and within localities of a particular park. Soils may differ significantly from place to place in a park and within very short distances as a result of complex interaction among the five factors. In some cases, however, parks may have vast stretches of the same type of soil because of uniform soil-forming factors.

Setting of Johnstown Flood National Memorial

Understanding the setting and geology of a park helps in understanding the parent materials contributing to the types of soils within it. Understanding the soils of the park also enhances understanding of the unique relationship between soils and the environment. Soil-forming processes are influenced by rock type, topographic expression, and the hydrologic properties of the area. Soil formation influences soil properties and behaviors, which are used to determine best management practices.

Johnstown Flood National Memorial lies along the Allegheny Front in central Pennsylvania, about 16 kilometers (10 miles) northeast of Johnstown. The park is located along the boundary between the Valley and Ridge and the Appalachian Plateaus physiographic provinces. This area displays a sharp contrast between the folded and faulted rocks on the eastern edge of the mountains and the eroded, horizontal beds (plateaus) on the western side (Thornberry-Ehrlich, 2008). The geologic units in the park are a heterogeneous mix of shale, sandstone, siltstone, limestone, dolomite, conglomerate, and mudstone. They contribute to different physical and chemical properties of the soils. Clay-rich units, such as shale and mudstone, form soils that when saturated with water are prone to fail when exposed on steep slopes.

The South Fork of the Little Conemaugh River flows through the park toward its confluence with the Little Conemaugh River and ultimately the Conemaugh River (which flows through the city of Johnstown). The park is located in southwestern Cambria County. The mountains in this area range in elevation from 346 to 734 meters (1,135 to 2,408 feet) above sea level (Thornberry-Ehrlich, 2008). Erosional downcutting of the landscape by rivers has helped create the soils on the landscape today.

The rocks in the Appalachian Plateaus province are relatively flat-lying and undeformed in contrast to the rocks of the Valley and Ridge province. Whether the parent rocks are undeformed or not is significant to the type of soils that form from the rock's weathering products. Deformation can result in different rock types that influence the size and composition of rock material and the minerals weathered from them. Rock weathering products in turn influence the morphology and composition of the soils that formed from them. The main unit of the park is on the divide between the Chesapeake Bay watershed to the east and the Ohio River basin to the west. Rolling hills and ridges characterize topography in the park. The ridgetops are composed of resistant Paleozoic sandstones. The valleys are underlain by less resistant units, such as carbonates and shales, that have preferentially eroded through time (Thornberry-Ehrlich, 2008).

Parent Material

The unconsolidated mass in which soils form is called parent material. Mineral soil parent material is a product of weathering of underlying bedrock in place or weathering of material that has been transported. Organic soils form in place from the accumulation and decomposition of plant material, such as wood, leaves, and aquatic plants. Weathering refers to the chemical and physical disintegration and decomposition of parent material. Few soils weather directly from the underlying rocks (residual parent material). More commonly, soils form in materials that have moved in from elsewhere. Soils generally have a dominant kind of parent material but are influenced by other types of parent material. Material may have been moved only a few feet by gravity (colluvial parent material) or been transported long distances by wind (eolian parent material) or water (alluvial parent material).

An example of eolian parent material is windblown loess. Windblown loess, which has been blown for long distances, consists mainly of silt-sized particles. It is common in parks of the Midwest. Because the past periglacial environment in northern Pennsylvania (see the Climate section below) was characterized by strong winds and silty glacial scour (and a possible secondary source of silt from the Ohio River basin lying to the west), there could be loess influence in the soils of Johnstown Flood National Memorial.

Alluvium, which is deposited by running water, can have different textures, depending on whether the water moves quickly or slowly. The type of rocks occurring in the source region of the streams and rivers also determine the characteristics of the alluvium. Fast-moving water deposits gravel, rocks, and sand. Slow-moving water leaves fine textured deposits (clay and silt) when sediments in the water settle out.

Figure 1.—Profile of a Philo soil. Philo soils formed mostly in alluvium and have a seasonal high water table below a depth of 2 feet. These soils are very deep, moderately well drained, and on flood plains. They formed in recent alluvium derived mainly from sandstone and shale. Scale is in feet. (Image is from the soil survey of the New River Gorge National River, West Virginia.)

Soils in the park that formed mainly from alluvium are Atkins soils, Philo soils (fig. 1), and Udifluvents. Soils derived from recent alluvium are extensive in the Conemaugh Lake lakebed.

Atkins soils formed in alluvium washed mainly from upland soils derived from interbedded acid sandstones and shales. The mechanism of flooding on Atkins soils usually involves shallow standing or slowly moving water on the soil surface. Atkins

Figure 2.—Reduced iron due to saturation (areas of grey) is evident in this close-up view of an Atkins soil.

soils are hydric due to saturation. The grey colors that are due to reduction of iron by saturation are visible in figure 2. Table 4 lists all hydric soils in the park. Table 19 gives some of the important hydrologic properties of the soils in the park.

Soils with residuum parent material formed directly from rocks or from an *in situ* plant source. Few soils actually form only from residuum. Most of the soils in Johnstown Flood National Memorial formed from a combination of residuum and colluvium. Berks soils are an example of soils in the park that formed mostly in residuum (fig. 3). These soils have angular fragments that are indicative of soils formed from residuum and colluvium.

Colluvium is material that has been acted upon by gravity. All sloping soils formed in colluvium as well as residuum. Both colluvial and residual parent materials in the park developed in material weathered from interbedded sandstone, siltstone, and, in some places, a minor component of shale. Stream valleys dividing high, rounded ridges characterize the topography of Johnstown Flood National Memorial. Valleys separate the ridgetops and are underlain by less resistant units, such as carbonate rocks and shale that have been preferentially eroded and carried down slope and deposited. The ridgetops are mostly composed of resistant Paleozoic sandstone. The dominant soils mapped on plateaus in and near the park are Cookport soils. Figure 4 shows the landscape positions of Cookport and other soils. Cookport soils are on broad, nearly level to gently sloping ridgetops and moderately steep side slopes. Level to gently sloping upland plateau, toeslope, and alluvial soil map units are often designated as prime farmland because of their favorable soil properties for crop production (see table 3). These soils also commonly have favorable land capability classifications (see table 2). Table 5 lists the major parent material type for the dominant soils in each map unit.

The majority of the soils in Johnstown Flood National Memorial developed in residuum and colluvium derived from acid siltstone and shale. Table 18 shows the typical pH ranges of the soils. Figures 5 and 6 are images of Cookport and Gilpin soils, which formed in residuum and colluvium. Because most of the soils in the park formed from siltstone, they have more than 40 percent silt in their horizons (see

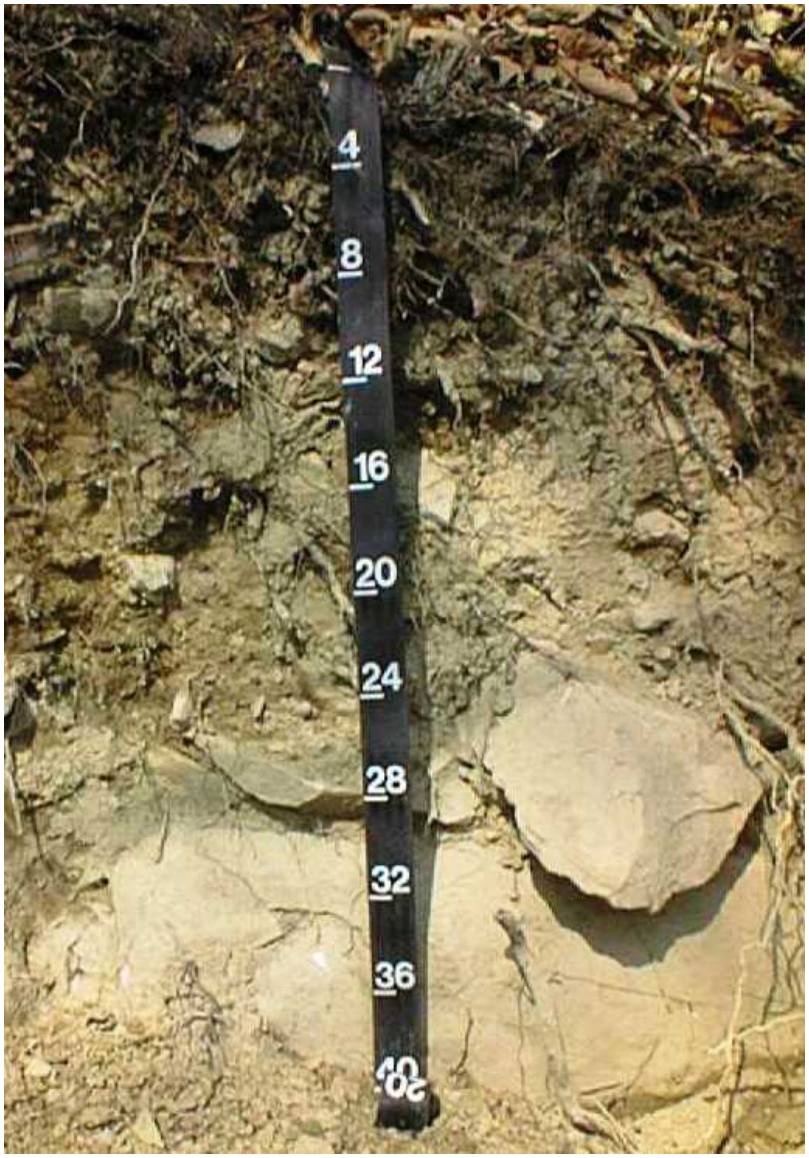

Figure 3.—A profile of a Berks soil. Berks soils formed predominantly in residuum. These soils are mapped along the east-facing crest of the Allegheny Front.

table 15). Soil textures that have a high silt content have a high water-holding capacity. However, these soils also have low plasticity and high liquid limits, which result in poor soil strength. Table 13 shows the rating for the soils in the park that may have limitations for pond reservoir areas, embankments, dikes, and levees. Because of their particle-size distribution many of the soils with a high silt content have limitations for these uses due to seepage, piping, and instability of excavated walls. Piping is erosion of the soil below the ground surface. Water removes soil particles and deposits them elsewhere. Voids are created due to the erosion of the soil subsurface layer, which can lead to sinkholes and collapse. If the Conmaugh Lake dam was created from the soils of the surrounding landscape, soil properties could have contributed to the dam's failure due to seepage that may have led to piping and slope failure.

Some parent materials favor the development of certain profile characteristics or diagnostic horizons. Ernest, Buchanan, Brinkerton, Laidig, and Cookport soils

Figure 4.—Relationship of soils and landscapes in the vicinity of the South Fork Fishing and Hunting Club reservoir.

in Johnstown Flood National Memorial all have a dense horizon called a fragipan. Fragipans are common in this area of Pennsylvania. The fragipan has a low content of organic matter and high bulk density in relation to horizons above it. These soils have restricted water movement due to the fragipan. Restricted water movement is evidenced in soil profiles by grey colors (see fig. 7). It is not known exactly how and why fragipans form but there are some generalizations that can be made about soils with fragipans. These soils: 1) show evidence of pedogenesis (usually clay movement), 2) have a higher content of silt and/or very fine sand than geographically associated soils without fragipans, 3) occur at depths where the soil does not freeze, and 4) typically formed under forested vegetation (Soil Survey Staff, 1999). All soils with a fragipan have “fragi” somewhere in their taxonomic name (see tables 21 and 22).

Climate

Differences in climate can result in differences in soils. Temperature and moisture influence soil formation and are the two most commonly measured features of climate. Weathering is most active when soils are moist and warm because these soil conditions are conducive to rapid chemical reactions and increased biological activity in the soil. Cooler temperatures result in slower chemical reactions. While average temperatures and precipitation are important in determining soil properties, the extremes of climate in any given locale also play a major role in soil formation.

Past Climate

The Allegheny Mountains developed periglacial conditions during the Ice Ages that intensified hillslope weathering processes (Means, 1995). Periglacial refers to

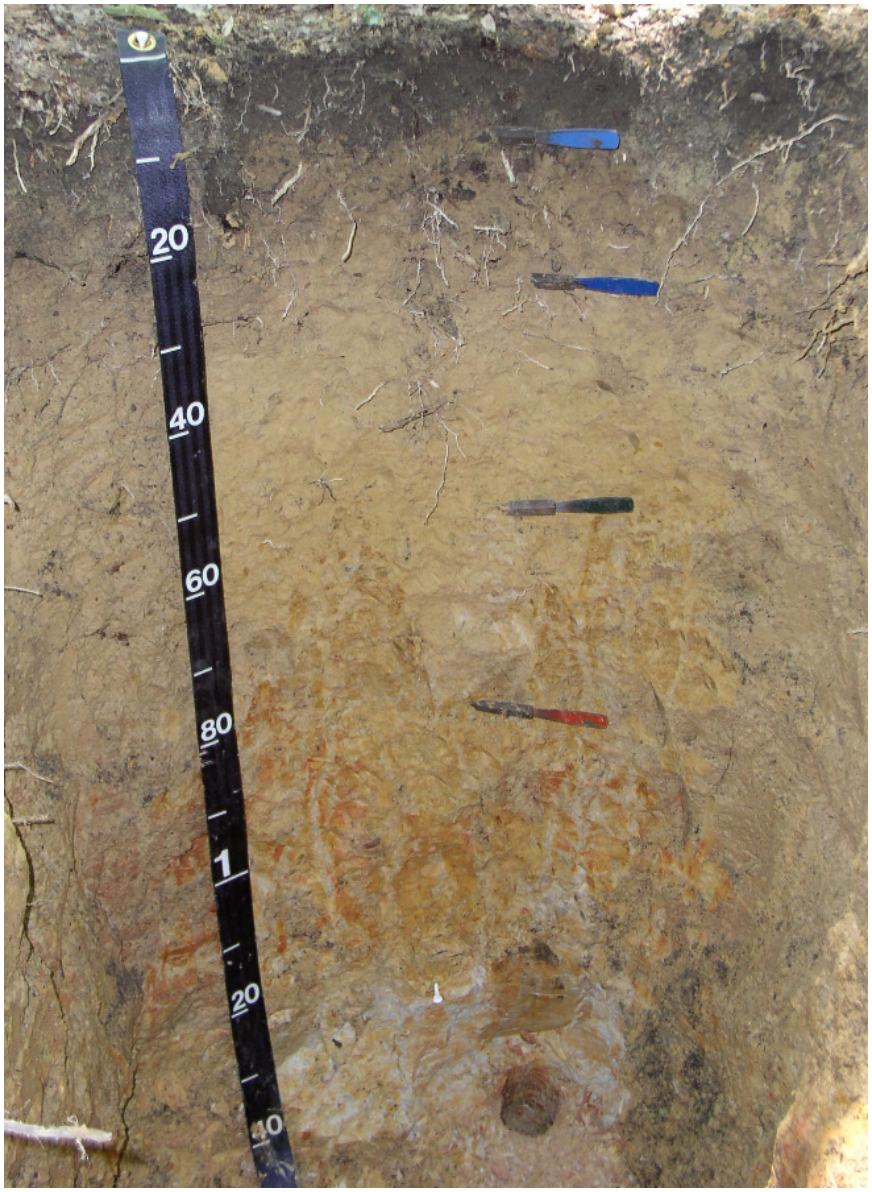

Figure 5.—Profile of a Cookport soil. Cookport soils are deep and formed in residuum and colluvium derived from sandstone. These soils have a thin O horizon over an A horizon that extends to depth of about 12 centimeters. The B horizon underlies the A horizon and extends to a depth of about 120 centimeters, where it overlies C horizon material. The layer below a depth of 80 centimeters, called a fragipan, restricts downward water movement. Scale is in centimeters and meters. (Image is from the soil survey of New River Gorge National River, West Virginia.)

conditions, processes, and landforms expected or found in areas adjacent to ice caps. The past periglacial environment included discontinuous permafrost, tundra-like vegetation, and many freeze-thaw cycles due to its proximity to the glacial environment (as it existed in northern Pennsylvania). Freeze-and-thaw cycles led to the ice wedging of boulders and small rocks. Water would melt during the day and seep into soil and cracks, freeze at night, and expand, which would then force the rocks apart. Movement of these rocks and soil created talus piles lower on the slopes. Large, water-saturated

Figure 6.—Profile of a Gilpin soil. Gilpin soils are on hillslopes and formed in residuum and colluvium, as evidenced by the angular rock fragments in the profile. These soils are generally less than 40 inches (100 centimeters) deep and over interbedded shale, sandstone, and siltstone. Numerous fine roots are concentrated near the surface. Scale is in centimeters. (Image is from the soil survey of New River Gorge National River, West Virginia.)

rock and soil masses would slowly slide downward over frozen or partially frozen ground in a process known as solifluction.

The Ice Age climate may have affected the morphology of the river valleys as well. The landforms and erosional deposits of the area are probably late Tertiary to Quaternary in age. Because of the wetter climate, sparse vegetation, and frozen ground, the amount of precipitation that drained into the post-glacial river channels was increased. Increased amounts of precipitation would have enhanced downcutting and erosion. The erosional deposits further weathered in place to form some of the

Figure 7.—Profile of a Laidig soil. Laidig soils are very deep, well drained soils that formed in colluvium derived from sandstone, siltstone, and some shale. These soils are on gently sloping to very steep benches and footslopes. The slight color change at a depth of 1 meter is where the fragipan occurs. (Image is from the soil survey of New River Gorge National River, West Virginia.)

park soils of today. Water gaps through the resistant ridges throughout the Valley and Ridge province are examples of incised waterways created during periglacial times.

Present Climate

Today, the area of the Appalachian Plateau where the park is located receives about 34 to 45 inches of precipitation per year. The rainfall occurs mostly in midsummer, and

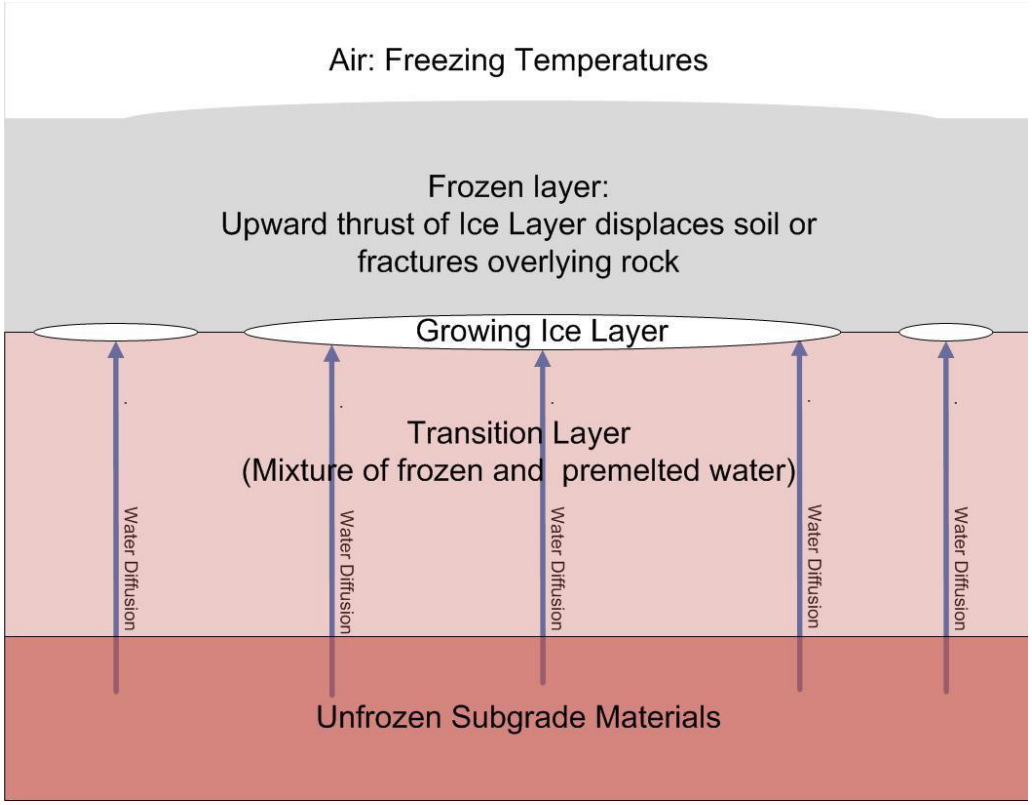

Figure 8.—Diagram illustrating ice lens formation in soils, which results in frost heave or frost action. (Image is from Williamborg [2009].)

the rest occurs in autumn and early winter. In summer the rainfall occurs during high-intensity storms. Annual snowfall averages less than 35 inches to more than 50 inches. The average annual temperature is 48 to 56 degrees F. Soils are usually moist (have an udic soil moisture regime) and have a mesic soil temperature regime. Some soils, such as Atkins, that are in low-lying positions have an aquic (usually wet) soil moisture regime (see fig. 2). Reduced iron appears as grey colors in the soil. Holly soils also are hydric (see table 4). Some soils also have seasonal wetness due to restricted water movement within the profile because of a dense fragipan. Table 19 lists the water features of the soils.

Climate and Frost Heave

Many of the soils in the park have a moderate or high susceptibility to frost heave. Frost heave is a natural pedogenic process that mixes and breaks up the soil surface. Table 20 lists the potential for frost heave, or frost action, as low, moderate, or high. Atkins, Armagh, Blairton, Brinkerton, Cavode, and Wharton soils have a high potential for frost action. Silty and loamy soils in mesic or frigid soil temperature regimes are susceptible to frost. Many of the soils in the park are affected by frost action. Many have fragipans that supply the source of water above the pan that can freeze and cause frost action.

Frost heave can result in road potholes and cracked pavements and foundations. Table 9 lists map units and soils that have a limitation for roads and streets due to frost action. This limitation results in higher maintenance costs for park roads and parking lots. Frost heave results from ice forming beneath the surface of soil during atmospheric freezing conditions. The ice grows in the direction of heat loss, which is vertically toward the surface, starting at the freezing boundary in the soil. A water

supply is needed to keep the ice crystals growing. The growing ice is restrained by overlying soil, which applies a load that limits its vertical growth and promotes the formation of a lens-shaped area of ice within the soil (fig. 8). The processes of frost heave were more intense during past glacial times than they are today.

During periods of rainfall or snowmelt, water carrying dissolved or suspended solids moves through the soil in a process called leaching. Leaching becomes active with the onset of rainfall or snowmelt. Different temperatures and moisture amounts cause different patterns of weathering and leaching in the soil. Seasonal and daily changes in temperature affect moisture effectiveness, biological activity, rates of chemical reactions, and kinds of vegetation.

Present-day climate variations in the park are the result of topography and relief. In most areas of the United States, temperature generally decreases with elevation and precipitation generally increases with elevation. As the amount of precipitation increases, the extent of leaching and the amount of vegetation generally increase to a point where they then decrease because of decreasing temperatures. Colder temperatures result in less leaching because of decreased microbial growth, decreased vegetation, and possibly frozen soil. Fluctuations in temperature and moisture affect the rate of organic matter production, decomposition, and accumulation and the weathering of minerals.

Some areas of the country have climates that are susceptible to wildfires. This condition is less common in Pennsylvania than in the western United States but wildfires can occur during periods of drought. Wildfires can alter physical and chemical properties of the soil. Erosion may be accelerated by the loss of vegetation and surface ground cover. Slopes may be destabilized by increased runoff.

Organisms

Plants, animals, micro-organisms, and humans affect the formation and shape of soils. Plants capture solar energy via photosynthesis and transfer that energy to the soil, energy that is a fundamental driver of many soil processes. Fungi and bacteria are the primary organisms that decompose organic matter and add nutrients to the soil. Animals and micro-organisms mix soils and form burrows and pores. Plant roots open channels in the soils. Abandoned tunnels commonly are filled with loose material from the overlying horizons and transmit water more readily than the surrounding undisturbed soil material. Micro-organisms affect chemical exchanges between roots and soil.

Different types of roots have different effects on soils. Grass roots are fibrous and decompose easily, adding organic matter to the soil. Fine grass roots can extend below the surface for many feet. Plant roots also help to develop soil structure and aggregate stability. Vegetation increases soil stability by protecting the surface against wind and water erosion. Tree taproots open pathways through dense layers.

The large plants of the forested ecosystem of Johnstown Flood National Memorial affect soil formation. Trees help break up rocks with their growing roots, resulting in channels that increase water penetration. Trees that are blown down help mix the soil when their roots are exposed. The shallow (less than 20 inches deep) Weikert soils are of minor extent in the park and associated with hard (lithic) rock outcrop that is slowing being fractured by tree roots. These soils have a high rock content in the subsoil and their depth is limited due to the hard rock. Most of the forested soils in the park are moderately deep or deeper (more than 20 inches deep).

Besides the mechanical breaking of rocks by large tree roots, trees capture energy and substance through photosynthesis, by the decomposition of plant residue, and by forming organic-mineral complexes that are recycled many times within the ecosystem (Buol et al., 2011).

Organisms, such as trees, contribute to the carbon content of soils. Table 17 lists an estimated organic carbon content of each of the soils in the park. Soil organic

carbon is carbon (C) in soil that originated from a biological source, such as plants, animals, or micro-organisms. Soil organic carbon makes up about one-half the weight of soil organic matter. As carbon levels in soil increase, carbon is “withdrawn” from the atmosphere and “secluded” in the soil. Carbon in the atmosphere (as CO_2 or CH_3) is implicated in global climate change. The process of soil carbon sequestration transfers CO_2 from the atmosphere into the soil. Trees transfer carbon to the soil by decomposition of leaves, needles, and roots. Based on available data, the soils with the highest SOC content are Armagh, Atkins, Cookport, and Philo. These soils each have 7 kg/m^2 of SOC, which equates to about 31 tons per acre.

The native vegetation depends on climate, topography, and biological factors plus many soil factors, such as soil density, depth, chemistry, temperature, and moisture. Leaves from plants fall to the surface and decompose on the soil. Organisms decompose these leaves and mix them with the upper part of the soil, resulting in cycling of nutrients and energy back to vegetation. The leaf litter, whether leaves or needles, helps prevent nutrient loss, conserves soil moisture, reduces raindrop impact, and limits frost penetration.

Human Effects on Soils

Abandoned and inactive mines with coal, coal overburden, and mine waste piles cause acid mine drainage and residual heavy metal contamination of ground water, surface water, and local soils. Most of the mine areas are upstream from the park (Thornberry-Ehrlich, 2008). Fluvial sediments (sediments carried by water) can contain metals and other waste materials that affect alluvial soils during periodic flooding. The acidity of coal-mine drainage is caused primarily by the oxidation of the mineral pyrite by bacteria (*Thiobacillus ferroxidans*). The rate of pyrite oxidation depends also on the reactive surface area of the pyrite, the oxygen concentration and pH of the water, and the forms of pyrite. Acid mine drainage can leach major elements, such as aluminum, calcium, and magnesium, and trace elements, such as copper and zinc, from surrounding rocks. Newly formed acidic, metal-rich waters can then flow into receiving streams. Mine drainage near the upstream communities of Saint Michael and Beaverdale flows through the park (Thornberry-Ehrlich, 2008). This flow is concentrated in the Little Conemaugh River, where high levels of aluminum, sulfates, and iron have contributed to white, orange, and yellow coloring of the riverbed and surrounding flood-plain soils. The water is toxic to fish and other aquatic species due in part to the human-modified soils along the river banks.

Time

Time for parent material, climate, organisms, and relief to interact with the soil is a soil-forming factor. Over time, soils exhibit features that reflect the interaction of other soil-forming factors. Recently deposited material, such as material deposited by a flood, exhibits no features from soil development activities; the properties of soils that formed in this material are mostly inherited from the new material. The previous soil surface and underlying horizons become buried. The time clock resets for these soils. The different horizons in a soil profile and the degree of development can be directly related to time. Terraces above the active flood plain, while similar in origin to the flood plain, are older land surfaces of old abandoned flood plains and thus their soils exhibit more horizon development.

A model of how time has acted as a soil-forming factor and the resultant degree of horizonation in the soils of Johnstown Flood National Memorial can be developed by looking at specific soils. The youngest soils in the park in terms of time or increasing soil age are Atkins soils, Udorthents, and Elkins soils. These soils have minimal soil horizonation and different parent materials. Elkins and Atkins soils are on the flood plains.

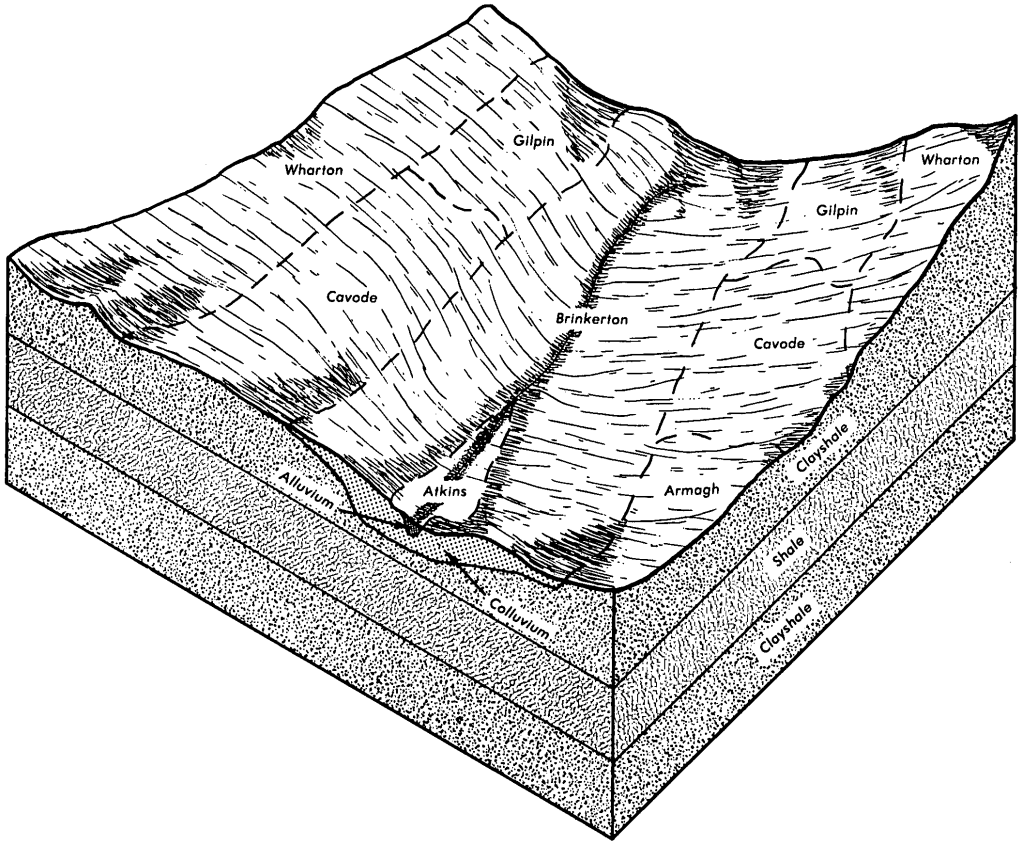

Figure 9.—Generalized relationships of soils to landscape and parent material on toeslopes and in drainageways in Johnstown Flood National Memorial.

Because of their active landscapes, Berks, Atkins, Philo, and Weikert soils are not strongly developed. For example, Atkins soils are subject to flooding while Berks and Weikert soils on hillslopes are subject to erosion. All of these soils have a simple A-B-C profile. The B horizon is a subsoil zone of accumulation of materials moved from O, A, or E horizons or of soil material formed in place. Color plays an important part in distinguishing B horizons. The B horizon is the horizon of maximum accumulation of dissolved or suspended materials, such as iron, clay, and calcium carbonate. However, not all soils have a B horizon. The B horizons in the above soils show some color change and weak structure. All of these soils are classified as Inceptisols.

The next oldest soils, in terms of degree of development or age, are Brinkerton soils. These soils formed in colluvium derived from acid gray shale and siltstone. They are nearly level to sloping and on concave footslopes and around heads of drainageways. They have A-B-C horizonation and greater development than the Inceptisols mentioned above. They differ from the Inceptisols in having stronger structure and a zone of clay accumulation in the B horizon, having moderately slow permeability in the upper part of the subsoil, and having slow permeability in a dense layer (fragipan) in the lower part of the subsoil. Brinkerton soils are seasonally wet. They are classified as Alfisols. Figure 9 illustrates the low-lying landscape position of Brinkerton soils.

The oldest soils in the park in terms of soil profile development are Cookport, Laidig, Gilpin, and Buchanan. These soils have different subsoil chemistry than the Alfisols due to leaching of cations. They are either older due to a more stable surface than

the Alfisols or, in some cases, are the most developed because of parent material differences (the chemistry of the parent material may have had fewer cations available to leach initially than the parent materials of the Alfisols). As mentioned previously, the other soil-forming factors influence how humans perceive time or soil age. The oldest or most developed soils in the park are classified as Ultisols.

Topography and Relief

Topography refers to the shape of the landscape, and relief refers to differences in elevation. The overall landscape in a park, whether it consists of plateaus, rolling hills, or steep mountains, is the result of erosion and depositional processes. These processes may have occurred in response to changes in climate, fluctuating sea levels, and/or tectonic activities. Cyclic periods of landscape stability and instability influence the types of soils that form on the landscape.

Slope and aspect of the overall landscape can affect the moisture and temperature of the soil. Steep slopes facing the sun are warmer and drier. Steep soils may be eroded and lose their surface horizons as they form. Thus, these soils may be thinner than the more nearly level ones that receive deposits from areas upslope. Deeper, darker soils may be expected on the bottom land. Soil-forming factors continue to affect soils even on stable landscapes. Materials are deposited on their surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity.

Most of the soils in Johnstown Flood National Memorial are affected by slope instability and high erosion rates if they are left unvegetated. The geologic units underlying the slopes of the park contain a heterogeneous mix of shale, sandstone, siltstone, limestone, dolomite, conglomerate, and mudstone. Clay-rich units (such as shale and mudstone) may disintegrate when they become saturated with water and are prone to fail when exposed on a slope. When more resistant rock units, such as sandstone and limestone, are located above weaker units, undercutting occurs from preferential erosion, causing rock fall hazards. Gilpin soils are moderately deep, well drained soils that formed in residuum of nearly horizontal interbedded shale, siltstone, and some sandstone of the Allegheny Plateau. These soils are mapped on gently sloping to steep, convex, dissected uplands. Figures 10 and 11 are stylized block diagrams of typical soils and landscapes found in the park.

Classification of the Soils

Soils are named and classified on the basis of physical and chemical properties in their horizons (layers). Color, texture, structure, and other properties of the soil to a depth of 2 meters are used to key the soil into a classification system. This system helps people to use soil information and also provides a common language for scientists.

Soils and their horizons differ from one another, depending on how and when they formed. Soil scientists use the five soil-forming factors to help predict where different soils may occur. The degree and expression of the soil horizons reflect the extent of interaction of the soil-forming factors with one or more of the soil-forming processes (Simonson, 1959).

When mapping soils, a soil scientist looks for areas with similar soil-forming factors to find similar soils. The properties of the soils are described. Soils with the same kind of properties are given taxonomic names. Soils are classified, mapped, and interpreted on the basis of various kinds of soil horizons and their arrangement. The distribution of soil orders corresponds with the general patterns of the soil-forming factors within the park.

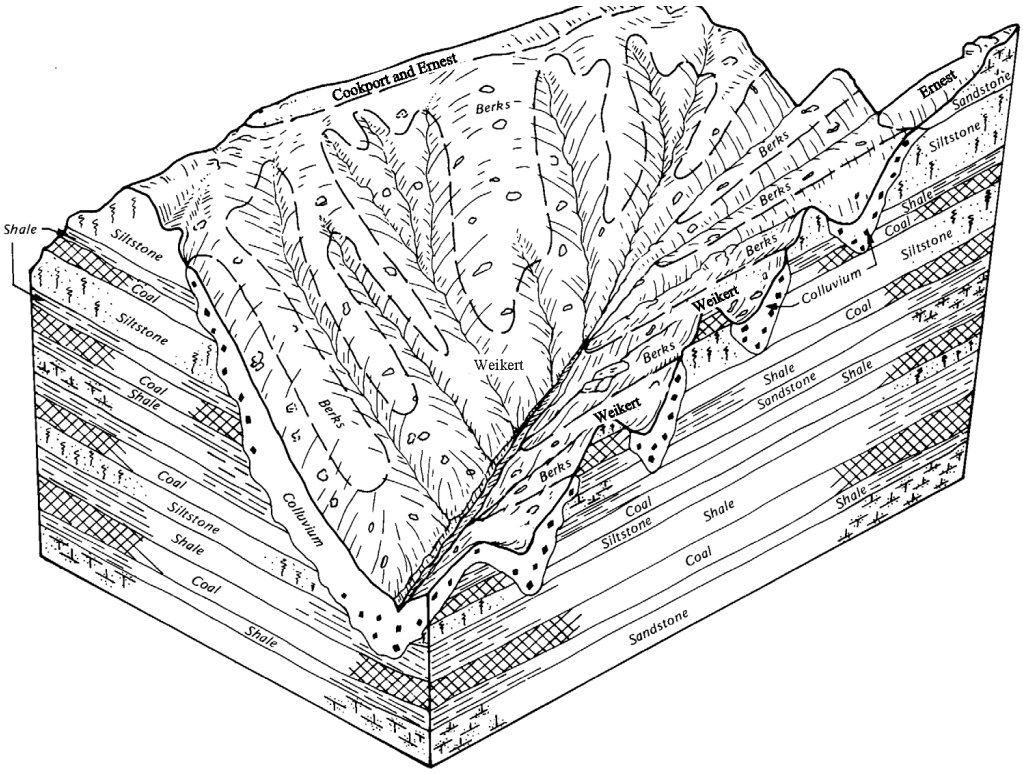

Figure 10.—Stylized representation of soil-landscape relationships in Johnstown Flood National Memorial.

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2010). 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. The categories are defined in the following paragraphs.

ORDER. Soil taxonomy at the highest hierarchical level identifies 12 soil orders. The names for the orders and taxonomic soil properties relate to Greek, Latin, or other root words that reveal something about the soil. 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 Ultisol.

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. Sixty-four suborders are recognized at the next level of classification. The last syllable in the name of a suborder indicates the order. An example is Udults (*Ud* meaning humid, plus *ult,* from Ultisol).

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; type of saturation; and base status. There are about 300 great groups. 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 Fragiudults (*Fragi,* indicating the presence of a fragipan, plus *Udult,* the suborder of the Ultisols that has a udic moisture regime).

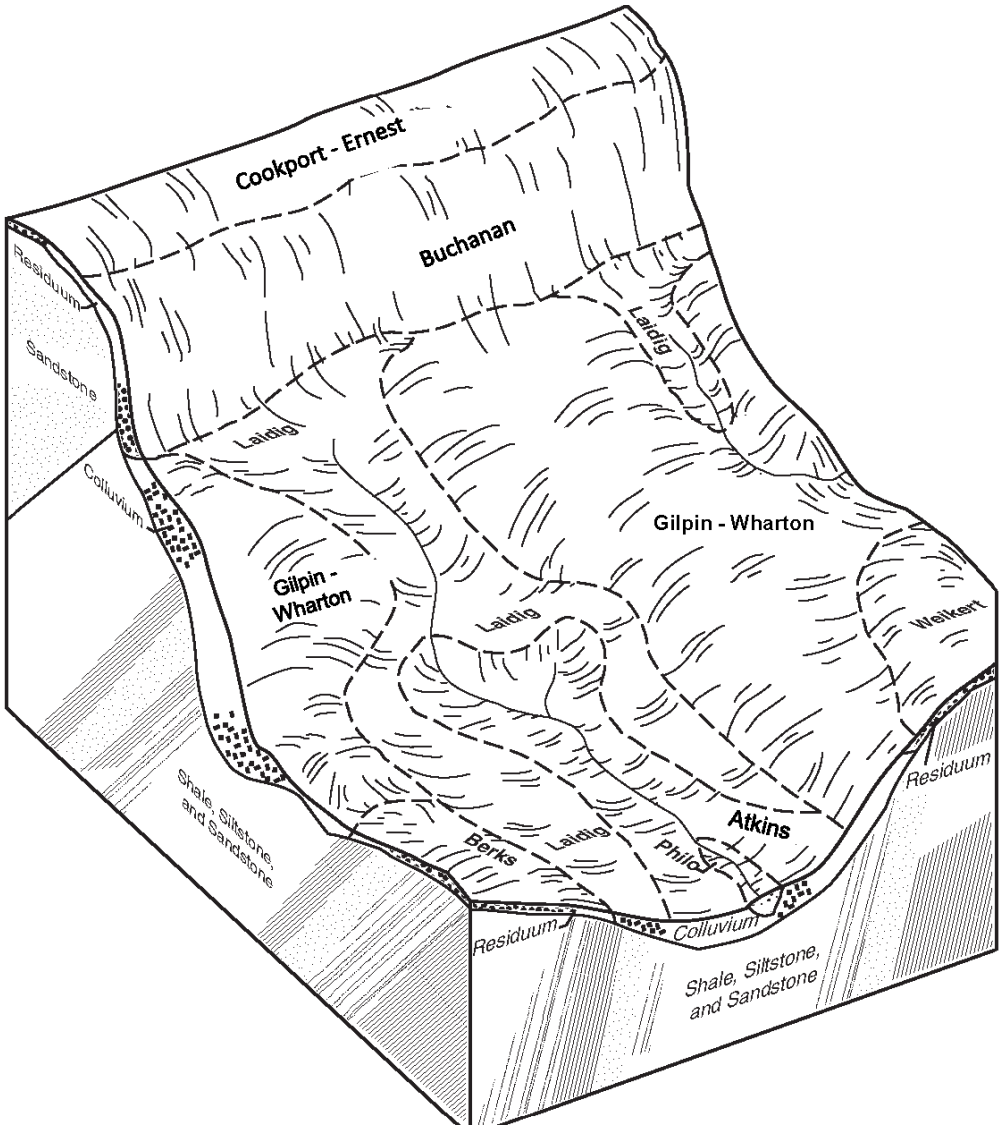

Figure 11.—General relationships of soils to topography and underlying parent material in the vicinity of Johnstown Flood National Memorial.

SUBGROUP. There are more than 2,400 subgroups. Each great group has a typic subgroup. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Other subgroups are intergrades or extragrades. 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aquic* identifies the subgroup that has some wetness and is wetter than the typical. An example is Aquic Fragiudults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties for family placement are those of horizons below a traditional agronomic plow depth. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil

depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, superactive, mesic Aquic Fragiudults.

SERIES. The soil series is the lowest category in the soil classification system. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. An example is the Ernest series, which classifies as fine-loamy, mixed, superactive, mesic Aquic Fragiudults.

Most parks are mapped to the series level. The names of soil series are selected by the soil scientists during the course of mapping. The series names are commonly geographic place names or are coined. Because of access limitations and soil variability, soils in some remote areas are classified at the great group or subgroup level.

Table 21 indicates the order, suborder, great group, subgroup, and family of the soil series in the park. Table 22 displays the classification as a key sorted by order.

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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.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

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:

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, and 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.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

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.

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.

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.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

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.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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 human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

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.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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 uppercase letter represents the major horizons. Numbers or lowercase 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:

O horizon.—An organic layer of fresh and decaying plant residue.

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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

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.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

K_{sat}. Saturated hydraulic conductivity. (See Permeability.)

Leaching. The removal of soluble material from soil or other material by percolating water.

LEP. See Linear extensibility percent.

Linear extensibility (LE). Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Linear extensibility percent. Refers to the percent change in linear extensibility.

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.
Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.
Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.
Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.
Neutral soil. A soil having a pH value of 6.6 to 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. The content of organic matter in the surface layer is described as follows:

Very low .....less than 0.5 percent
Low ..... 0.5 to 1.0 percent
Moderately low..... 1.0 to 2.0 percent
Moderate..... 2.0 to 4.0 percent
High ..... 4.0 to 8.0 percent
Very high.....more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.
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.
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 movement of water through the soil.
Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow.....0.0 to 0.01 inch
Very slow .....0.01 to 0.06 inch
Slow .....0.06 to 0.2 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, such as slope, stoniness, and flooding.
pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, 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. Unless the soils are artificially drained, 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.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

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.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

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 degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

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.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

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.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

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.

Series, soil. A group of soils that have profiles that are almost alike. 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.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

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.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

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, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. 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.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) 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, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

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 generally is 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.”

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

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.

Tables

Table 1.—Soil Legend

Map unit symbol and map unit name	Components in map unit	Percent of map unit
541887:		
Armagh silt loam, 0 to 8 percent slopes	Armagh	85
	Cavode	10
	Armagh, very stony	5
541888:		
Atkins silt loam	Atkins	85
	Basher	5
	Elkins	5
	Philo	5
541889:		
Berks channery silt loam, 3 to 8 percent slopes	Berks	85
	Bedington	3
	Ernest	3
	Blairton	2
	Weikert	2
541892:		
Blairton silt loam, 3 to 8 percent slopes	Blairton	90
	Brinkerton	5
541896:		
Brinkerton silt loam, 0 to 8 percent slopes	Brinkerton	90
	Ernest	10
541900:		
Cavode silt loam, 8 to 15 percent slopes	Cavode	85
	Gilpin	10
	Brinkerton	5
541903:		
Cookport and Ernest soils, 3 to 8 percent slopes	Cookport	65
	Ernest	25
	Brinkerton	10
541904:		
Cookport and Ernest soils, 8 to 15 percent slopes	Cookport	70
	Ernest	25
	Brinkerton	5
541907:		
Cookport and Ernest very stony soils, 8 to 25 percent slopes	Cookport	70
	Ernest	25
	Brinkerton	5

Table 1.—Soil Legend—Continued

Map unit symbol and map unit name	Components in map unit	Percent of map unit
541915:		
Gilpin-Rayne silt loams, 15 to 25 percent slopes	Gilpin	70
	Rayne	30
541925:		
Laidig soils, 25 to 70 percent slopes	Laidig	100
541933:		
Philo silt loam	Philo	90
	Atkins	10
541941:		
Urban land-Udorthents complex, sloping	Urban land	60
	Udorthents	30
	Wet spots	1
541942:		
Water	Water	100
541943:		
Wharton silt loam, 3 to 8 percent slopes	Wharton	80
	Cavode	8
	Buchanan	5
	Hartleton	5
	Brinkerton	2

Table 2.—Land Capability Classification

(Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time. Only the soils suitable for cultivation are listed. The classification is for nonirrigated areas)

Map unit symbol and component name	Land capability
541887:	
Armagh	4w
541888:	
Atkins	3w
541889:	
Berks	2e
541892:	
Blairton	3w
541896:	
Brinkerton	4w
541900:	
Cavode	3e
541903:	
Cookport	2e
Ernest	2e
541904:	
Cookport	3e
Ernest	3e
541907:	
Cookport	6s
Ernest	6s
541915:	
Gilpin	4e
Rayne	4e
541925:	
Laidig	7e
541933:	
Philo	2w
541941:	
Udorthents	7s
541943:	
Wharton	2e

Table 3.—Prime and Other Important Farmland

(Only the soils considered prime or important farmland are listed. Urban or built-up areas of the soils listed are not considered prime or important farmland)

Map unit symbol	Map unit name	Farmland classification
541888	Atkins silt loam	Farmland of statewide importance
541889	Berks channery silt loam, 3 to 8 percent slopes	Farmland of statewide importance
541892	Blairton silt loam, 3 to 8 percent slopes	Farmland of statewide importance
541900	Cavode silt loam, 8 to 15 percent slopes	Farmland of statewide importance
541903	Cookport and Ernest soils, 3 to 8 percent slopes	All areas are prime farmland
541904	Cookport and Ernest soils, 8 to 15 percent slopes	Farmland of statewide importance
541933	Philo silt loam	All areas are prime farmland
541943	Wharton silt loam, 3 to 8 percent slopes	All areas are prime farmland

Table 4.—Hydric Soils

(This report lists only those map unit components that are rated as hydric. Definitions of hydric criteria codes are included at the end of the report)

Map unit symbol and map unit name	Component	Percent of map unit	Landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
541887:							
Armagh silt loam, 0 to 8 percent slopes	Armagh	85	hills and depressions	2B3	Yes	No	No
	Armagh, very stony	5	depressions on hills	2B3	Yes	No	No
541888:							
Atkins silt loam	Atkins	85	flood plains	2B3	Yes	No	No
	Elkins	5	flood plains	2B3	Yes	No	No
541892:							
Blairton silt loam, 3 to 8 percent slopes	Brinkerton	5	hills	2B3	Yes	No	No
541896:							
Brinkerton silt loam, 0 to 8 percent slopes	Brinkerton	90	depressions	2B3	Yes	No	No
541900:							
Cavode silt loam, 8 to 15 percent slopes	Brinkerton	5	hills and draws	2B3	Yes	No	No
541903:							
Cookport and Ernest soils, 3 to 8 percent slopes	Brinkerton	10	depressions	2B3	Yes	No	No
541904:							
Cookport and Ernest soils, 8 to 15 percent slopes	Brinkerton	5	depressions	2B3	Yes	No	No
541907:							
Cookport and Ernest soils, 8 to 25 percent slopes	Brinkerton	5	depressions	2B3	Yes	No	No
541933:							
Philo silt loam	Atkins	10	flood plains	2B3	Yes	No	No
541941:							
Urban land-Udorthents complex, sloping	Wet spots	1	depressions	2B3	Yes	No	No

Table 4.—Hydric Soils—Continued

Map unit symbol and map unit name	Component	Percent of map unit	Landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
541943: Wharton silt loam, 3 to 8 percent slopes	Brinkerton	2	sloughs	2B3	Yes	No	No

Explanation of hydric criteria codes

1. All Histels (except for Folistels), and Histosols (except for Folists), which are, by definition, saturated.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Table 5.—Landform and Parent Material

(Only major components are displayed in this report. MAP is the mean annual precipitation)

Map unit symbol and soil name	Percent of map unit	Slope	MAP	Landform	Parent material
	Pct	Pct	In		
541887:					
Armagh	85	0-8	35-51	Depression	Residuum weathered from shale
541888:					
Atkins	85	0-3	38-46	Flood plain	---
541889:					
Berks	85	3-8	36-50	Shale hillslope	Acid silty residuum weathered from shale and siltstone
541892:					
Blairton	90	3-8	36-50	Depression	Local silty colluvium derived from shale and siltstone over acid silty residuum weathered from shale and siltstone
541896:					
Brinkerton	90	0-8	35-50	Depression	Colluvium derived from shale and siltstone
541900:					
Cavode	85	8-15	36-46	Hillslope	Acid clayey residuum weathered from clayey shale
541903:					
Cookport	65	3-8	37-65	Hillslope	Residuum weathered from acid sandstone
Ernest	25	3-8	30-65	Hillslope	Colluvium derived from shale and siltstone
541904:					
Cookport	70	8-15	37-65	Hillslope	Residuum weathered from acid sandstone
Ernest	25	8-15	30-65	Hillslope	Colluvium derived from shale and siltstone
541907:					
Cookport	70	8-25	37-65	---	Colluvium derived from sandstone and siltstone
Ernest	25	8-25	30-65	---	Colluvium derived from shale and siltstone

Table 5.—Landform and Parent Material—Continued

Map unit symbol and soil name	Percent of map unit	Slope	MAP	Landform	Parent material
	Pct	Pct	In		
541915:					
Gilpin	70	15-25	37-65	Hillslope	Residuum weathered from interbedded sedimentary rock
Rayne	30	15-25	37-65	Hill	Residuum weathered from interbedded sedimentary rock
541925:					
Laidig	100	25-70	34-60	Hill	Mountain slope fine-loamy colluvium derived from interbedded sedimentary rock
541933:					
Philo	90	0-2	40-55	Flood plain	Recent coarse-loamy alluvium derived from sandstone and shale
541941:					
Urban land.					
Udorthents	30	8-15	35-45	---	Manmade and altered materials from mixed rock types
541942.					
Water					
541943:					
Wharton	80	3-8	38-46	Hill	Fine-loamy residuum weathered from shale and siltstone

Table 6.—Land Management, Part I (Planting)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
541887:							
Armagh	85	Well suited		Well suited		Severe	
						Low strength	1.00
541888:							
Atkins	85	Well suited		Well suited		Severe	
						Low strength	1.00
541889:							
Berks	85	Well suited		Moderately suited		Moderate	
				Rock fragments	0.50	Low strength	0.50
				Slope	0.50		
541892:							
Blairton	90	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
				Rock fragments	0.50		
541896:							
Brinkerton	90	Well suited		Well suited		Severe	
						Low strength	1.00
541900:							
Cavode	85	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
541903:							
Cookport	65	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Ernest	25	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
541904:							
Cookport	70	Well suited		Moderately suited		Moderate	
				Slope	0.50	Low strength	0.50
Ernest	25	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
541907:							
Cookport	70	Well suited		Poorly suited		Moderate	
				Slope	0.75	Low strength	0.50
				Rock fragments	0.50		
Ernest	25	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00
				Rock fragments	0.50		
541915:							
Gilpin	70	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00
				Rock fragments	0.50		
Rayne	30	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00

Table 6.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
541925:							
Laidig	100	Moderately suited		Unsuited		Severe	
		Slope	0.50	Slope	1.00	Low strength	1.00
				Rock fragments	0.50		
541933:							
Philo	90	Well suited		Well suited		Severe	
						Low strength	1.00
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Moderately suited		Unsuited		Moderate	
		Rock fragments	0.50	Rock fragments	1.00	Low strength	0.50
				Slope	0.50		
541942:							
Water	100	Not rated		Not rated		Not rated	
541943:							
Wharton	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
				Rock fragments	0.50		

Table 6.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
541887:							
Armagh	85	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Wetness	1.00
						Low strength	0.50
541888:							
Atkins	85	Slight		Slight		Poorly suited	
						Flooding	1.00
						Wetness	1.00
						Low strength	0.50
541889:							
Berks	85	Slight		Slight		Moderately suited	
						Slope	0.50
541892:							
Blairton	90	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Wetness	0.50
						Low strength	0.50
						Slope	0.50
541896:							
Brinkerton	90	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Wetness	1.00
						Low strength	0.50
541900:							
Cavode	85	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Wetness	0.50
						Low strength	0.50
						Landslides	0.35
541903:							
Cookport	65	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
Ernest	25	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Wetness	0.50
						Low strength	0.50
						Slope	0.50
541904:							
Cookport	70	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
Ernest	25	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Wetness	0.50
						Low strength	0.50
541907:							
Cookport	70	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Wetness	1.00
						Slope	1.00
						Dusty	0.02

Table 6.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
541907:							
Ernest	25	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Wetness	0.50
						Low strength	0.50
						Dusty	0.04
541915:							
Gilpin	70	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
Rayne	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
541925:							
Laidig	100	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
541933:							
Philo	90	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
						Wetness	0.50
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Low strength	0.50
541942:							
Water	100	Not rated		Not rated		Not rated	
541943:							
Wharton	80	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
						Slope	0.50

Table 6.—Land Management, Part III (Site Preparation)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep): Rating class and limiting features	Value	Suitability for mechanical site preparation (surface): Rating class and limiting features	Value
541887:					
Armagh	85	Well suited		Well suited	
541888:					
Atkins	85	Well suited		Well suited	
541889:					
Berks	85	Unsuited		Well suited	
		Restrictive layer	1.00		
541892:					
Blairton	90	Unsuited		Well suited	
		Restrictive layer	1.00		
541896:					
Brinkerton	90	Well suited		Well suited	
541900:					
Cavode	85	Well suited		Well suited	
541903:					
Cookport	65	Well suited		Well suited	
Ernest	25	Well suited		Well suited	
541904:					
Cookport	70	Well suited		Well suited	
Ernest	25	Well suited		Well suited	
541907:					
Cookport	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
Ernest	25	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
541915:					
Gilpin	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
Rayne	30	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
541925:					
Laidig	100	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
541933:					
Philo	90	Well suited		Well suited	
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	Well suited		Poorly suited	
				Rock fragments	0.50

Table 6.—Land Management, Part III (Site Preparation)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep): Rating class and limiting features	Value	Suitability for mechanical site preparation (surface): Rating class and limiting features	Value
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Well suited		Well suited	

Table 6.—Land Management, Part IV (Site Restoration)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
541887:					
Armagh	85	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541888:					
Atkins	85	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541889:					
Berks	85	Moderate		Low	
		Texture/rock fragments	0.50		
541892:					
Blairton	90	Low		Low	
		Texture/rock fragments	0.10		
541896:					
Brinkerton	90	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541900:					
Cavode	85	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541903:					
Cookport	65	Low		Low	
		Texture/rock fragments	0.10		
Ernest	25	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541904:					
Cookport	70	Low		Low	
		Texture/rock fragments	0.10		
Ernest	25	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
541907:					
Cookport	70	Low		High	
				Wetness	1.00
Ernest	25	Low		High	
				Wetness	1.00

Table 6.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
541915:					
Gilpin	70	Low		Low	
		Texture/rock fragments	0.10		
Rayne	30	Low		Low	
		Texture/rock fragments	0.10		
541925:					
Laidig	100	Low		Low	
541933:					
Philo	90	Low		Low	
		Texture/rock fragments	0.10		
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	High		Low	
		Texture/rock fragments	1.00		
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Low		Low	
		Texture/rock fragments	0.10		

Table 7.—Recreation, Part I (Camp and Picnic Areas)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
541887:					
Armagh	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slow water movement	0.96	Slow water movement	0.96
541888:					
Atkins	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	1.00	Flooding	0.40
541889:					
Berks	85	Somewhat limited		Somewhat limited	
		Gravel	0.39	Gravel	0.39
541892:					
Blairton	90	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.81	Depth to saturated zone	0.48
		Slow water movement	0.21	Slow water movement	0.21
541896:					
Brinkerton	90	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
541900:					
Cavode	85	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Depth to saturated zone	0.98
		Slow water movement	0.96	Slow water movement	0.96
		Slope	0.63	Slope	0.63
541903:					
Cookport	65	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.39	Depth to saturated zone	0.19
		Gravel	0.16	Gravel	0.16
Ernest	25	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Depth to saturated zone	0.90
541904:					
Cookport	70	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
		Depth to saturated zone	0.39	Depth to saturated zone	0.19
		Gravel	0.16	Gravel	0.16

Table 7.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Value	Picnic areas: Rating class and limiting features	Value
541904:					
Ernest	25	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Depth to saturated zone	0.90
		Slope	0.63	Slope	0.63
541907:					
Cookport	70	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slope	1.00	Slope	1.00
		Large stones content	0.53	Large stones content	0.53
		Dusty	0.02	Dusty	0.02
		Gravel content	0.01	Gravel content	0.01
Ernest	25	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slope	1.00	Depth to saturated zone	0.90
		Large stones content	0.53	Large stones content	0.53
		Dusty	0.04	Dusty	0.04
		Gravel content	0.01	Gravel content	0.01
541915:					
Gilpin	70	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Rayne	30	Very limited		Very limited	
		Slope	1.00	Slope	1.00
541925:					
Laidig	100	Very limited		Very limited	
		Slope	1.00	Slope	1.00
541933:					
Philo	90	Very limited		Somewhat limited	
		Flooding	1.00	Depth to saturated zone	0.48
		Depth to saturated zone	0.81		
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
		Large stones content	0.32	Large stones content	0.32
		Gravel	0.02	Gravel	0.02
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.43	Slow water movement	0.43
		Depth to saturated zone	0.07	Depth to saturated zone	0.03

Table 7.—Recreation, Part II (Trail Management)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
541887:					
Armagh	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
541888:					
Atkins	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	0.40	Flooding	0.40
541889:					
Berks	85	Not limited		Not limited	
541892:					
Blairton	90	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.11	Depth to saturated zone	0.11
541896:					
Brinkerton	90	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
541900:					
Cavode	85	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Depth to saturated zone	0.94	Depth to saturated zone	0.94
541903:					
Cookport	65	Not limited		Not limited	
Ernest	25	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.78	Depth to saturated zone	0.78
541904:					
Cookport	70	Not limited		Not limited	
		Depth to saturated zone	0.78	Depth to saturated zone	0.78
Ernest	25	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Depth to saturated zone	0.78	Depth to saturated zone	0.78
541907:					
Cookport	70	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Large stones content	0.53	Large stones content	0.53
		Slope	0.08	Dusty	0.02
		Dusty	0.02		

Table 7.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
541907:					
Ernest	25	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.78	Depth to saturated zone	0.78
		Large stones content	0.53	Large stones content	0.53
		Slope	0.08	Dusty	0.04
		Dusty	0.04		
541915:					
Gilpin	70	Somewhat limited		Not limited	
		Slope	0.50		
Rayne	30	Somewhat limited		Not limited	
		Slope	0.50		
541925:					
Laidig	100	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.78
541933:					
Philo	90	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.11	Depth to saturated zone	0.11
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	Somewhat limited		Somewhat limited	
		Large stones content	0.32	Large stones content	0.32
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Not limited		Not limited	

Table 8.—Dwellings and Small Commercial Buildings

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
541887:							
Armagh	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
541888:							
Atkins	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
541889:							
Berks	85	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.15	Depth to hard bedrock	1.00	Slope	0.50
						Depth to hard bedrock	0.15
541892:							
Blairton	90	Somewhat limited		Very limited		Somewhat limited	
		Depth to saturated zone	0.81	Depth to saturated zone	1.00	Depth to saturated zone	0.81
		Depth to hard bedrock	0.79	Depth to hard bedrock	1.00	Depth to hard bedrock	0.79
						Slope	0.50
541896:							
Brinkerton	90	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Shrink-swell	0.50			Shrink-swell	0.50
		Depth to thin cemented pan	0.50				
541900:							
Cavode	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Slope	1.00
		Slope	0.63	Slope	0.63	Depth to saturated zone	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
				Depth to hard bedrock	0.02		
541903:							
Cookport	65	Somewhat limited		Very limited		Somewhat limited	
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00	Slope	0.50
		Depth to saturated zone	0.39			Depth to saturated zone	0.39
Ernest	25	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Slope	0.50
		Depth to thin cemented pan	0.50			Shrink-swell	0.50

Table 8.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
541904:							
Cookport	70	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to saturated zone	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Slope	0.63	Depth to saturated zone	0.39
		Depth to saturated zone	0.39				
Ernest	25	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Slope	1.00
		Slope	0.63	Slope	0.63	Depth to saturated zone	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
		Depth to thin cemented pan	0.50				
541907:							
Cookport	70	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to saturated zone	1.00
		Depth to thin cemented pan	0.50				
Ernest	25	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to saturated zone	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
		Depth to thin cemented pan	0.50				
541915:							
Gilpin	70	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to hard bedrock	0.01	Depth to hard bedrock	1.00	Depth to hard bedrock	0.01
Rayne	30	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
541925:							
Laidig	100	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00		
541933:							
Philo	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.81	Depth to saturated zone	1.00	Depth to saturated zone	0.81
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Very limited		Very limited		Very limited	
		Large stones	1.00	Large stones	1.00	Slope	1.00
		Slope	0.63	Slope	0.63	Large stones	1.00

Table 8.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
541942:							
Water	100	Not rated		Not rated		Not rated	
541943:							
Wharton	80	Somewhat limited		Very limited		Somewhat limited	
		Shrink-swell	0.50	Depth to saturated zone	1.00	Slope	0.50
		Depth to saturated zone	0.07	Shrink-swell	0.50	Shrink-swell	0.50
						Depth to saturated zone	0.07

Table 9.—Roads and Streets, Shallow Excavations, and Landscaping

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
541887:							
Armagh	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
		Shrink-swell	0.50				
541888:							
Atkins	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Flooding	1.00
		Frost action	1.00	Flooding	0.80	Depth to saturated zone	1.00
		Flooding	1.00	Unstable excavation walls	0.10		
		Low strength	0.22				
541889:							
Berks	85	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.15	Depth to hard bedrock	1.00	Droughty	0.81
				Unstable excavation walls	0.10	Gravel	0.39
						Large stones	0.32
						Depth to bedrock	0.16
541892:							
Blairton	90	Very limited		Very limited		Somewhat limited	
		Frost action	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.80
		Depth to hard bedrock	0.79	Depth to saturated zone	1.00	Depth to saturated zone	0.48
		Depth to saturated zone	0.48	Unstable excavation walls	0.10	Droughty	0.33
541896:							
Brinkerton	90	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
		Shrink-swell	0.50				
541900:							
Cavode	85	Very limited		Very limited		Somewhat limited	
		Frost action	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.98
		Low strength	1.00	Slope	0.63	Slope	0.63
		Depth to saturated zone	0.98	Unstable excavation walls	0.10	Large stones	0.05
		Slope	0.63	Depth to hard bedrock	0.02		
		Shrink-swell	0.50				

Table 9.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
541903:							
Cookport	65	Somewhat limited		Very limited		Somewhat limited	
		Frost action	0.50	Depth to saturated zone	1.00	Depth to saturated zone	0.19
		Depth to saturated zone	0.19	Unstable excavation walls	0.10	Gravel	0.16
						Large stones	0.03
Ernest	25	Very limited		Very limited		Somewhat limited	
		Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.90
		Depth to saturated zone	0.90	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
		Frost action	0.50				
541904:							
Cookport	70	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.63	Depth to saturated zone	1.00	Slope	0.63
		Frost action	0.50	Slope	0.63	Depth to saturated zone	0.19
		Depth to saturated zone	0.19	Unstable excavation walls	0.10	Gravel	0.16
						Large stones	0.03
Ernest	25	Very limited		Very limited		Somewhat limited	
		Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.90
		Depth to saturated zone	0.90	Slope	0.63	Slope	0.63
		Slope	0.63	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
		Frost action	0.50				
541907:							
Cookport	70	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to thin cemented pan	1.00	Depth to saturated zone	1.00
		Depth to thin cemented pan	1.00	Depth to saturated zone	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Large stones content	0.95
		Frost action	0.50	Dusty		Dusty	0.02
		Depth to thick cemented pan	0.20	Unstable excavation walls	0.02	Gravel content	
					0.01		0.01
Ernest	25	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Slope	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Depth to saturated zone	0.90
		Slope	1.00	Depth to saturated zone	1.00	Large stones content	0.26
		Low strength	1.00	Slope	1.00	Dusty	0.04
		Depth to saturated zone	0.90	Dusty	0.04	Gravel content	0.01
541915:							
Gilpin	70	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Frost action	0.50	Slope	1.00	Depth to bedrock	0.01
		Depth to hard bedrock	0.01	Unstable excavation walls	0.10		
Rayne	30	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Frost action	0.50	Unstable excavation walls	0.10		

Table 9.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
541925:							
Laidig	100	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Frost action	0.50	Depth to saturated zone	1.00		
				Unstable excavation walls	0.10		
541933:							
Philo	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Depth to saturated zone	1.00	Flooding	0.60
		Frost action	0.50	Unstable excavation walls	1.00	Depth to saturated zone	0.48
		Depth to saturated zone	0.48	Flooding	0.60		
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Very limited		Very limited		Very limited	
		Large stones	1.00	Large stones	1.00	Large stones	1.00
		Slope	0.63	Slope	0.63	Droughty	1.00
				Unstable excavation walls	0.10	Slope	0.63
						Gravel	0.02
541942:							
Water	100	Not rated		Not rated		Not rated	
541943:							
Wharton	80	Very limited		Very limited		Somewhat limited	
		Frost action	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.03
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
		Depth to saturated zone	0.03				

Table 10.—Sewage Disposal

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
541887:					
Armagh	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slow water movement	1.00	Slope	0.32
		Depth to bedrock	0.24		
541888:					
Atkins	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.78		
541889:					
Berks	85	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.92
541892:					
Blairton	90	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	0.94
		Slow water movement	0.72	Slope	0.92
				Seepage	0.28
541896:					
Brinkerton	90	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slow water movement	1.00	Seepage	0.53
				Slope	0.32
541900:					
Cavode	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Slope	0.63	Depth to hard bedrock	0.02
		Depth to bedrock	0.38		

Table 10.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
541903:					
Cookport	65	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Slope	0.92
		Slow water movement	1.00	Depth to saturated zone	0.75
		Depth to bedrock	0.24	Seepage	0.53
Ernest	25	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Slow water movement	1.00	Slope	0.92
				Seepage	0.53
541904:					
Cookport	70	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	0.75
		Slope	0.63	Seepage	0.53
		Depth to bedrock	0.24		
Ernest	25	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Slope	0.63	Seepage	0.53
541907:					
Cookport	70	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Slope	1.00	Seepage	0.53
		Depth to bedrock	0.25		
Ernest	25	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Slope	1.00	Seepage	0.53
541915:					
Gilpin	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
		Slow water movement	0.46	Seepage	0.53
Rayne	30	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Slow water movement	0.46	Seepage	0.53
		Depth to bedrock	0.24		

Table 10.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
541925:					
Laidig	100	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Seepage	1.00
		Slope	1.00	Depth to saturated zone	0.19
541933:					
Philo	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Seepage	1.00
		Seepage, bottom layer	1.00	Depth to saturated zone	1.00
		Slow water movement	0.46		
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	Very limited		Very limited	
		Seepage, bottom layer	1.00	Slope	1.00
		Large stones	1.00	Large stones	1.00
		Filtering capacity	1.00	Seepage	1.00
		Slope	0.63		
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Very limited		Somewhat limited	
		Depth to saturated zone	1.00	Slope	0.92
		Slow water movement	1.00	Depth to saturated zone	0.44
		Depth to bedrock	0.24		

Table 11.—Source of Gravel and Sand

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
541887:					
Armagh	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541888:					
Atkins	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541889:					
Berks	85	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
541892:					
Blairton	90	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.25	Thickest layer	0.00
541896:					
Brinkerton	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541900:					
Cavode	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541903:					
Cookport	65	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.04
		Thickest layer	0.00	Thickest layer	0.04
Ernest	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541904:					
Cookport	70	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.04
		Thickest layer	0.00	Thickest layer	0.04
Ernest	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541907:					
Cookport	70	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.04

Table 11.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
541907:					
Ernest	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541915:					
Gilpin	70	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.25	Thickest layer	0.00
Rayne	30	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
541925:					
Laidig	100	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541933:					
Philo	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541941:					
Urban land	60	Not rated		Not rated	
Udorthents	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
541942:					
Water	100	Not rated		Not rated	
541943:					
Wharton	80	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00

Table 12.—Source of Reclamation Material, Roadfill, and Topsoil

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
541887:							
Armagh	85	Fair		Poor		Poor	
		Too clayey	0.02	Wetness	0.00	Wetness	0.00
		Low content of organic matter	0.12	Low strength	0.00	Too clayey	0.01
		Too acid	0.32	Shrink-swell	0.89	Hard to reclaim (rock fragments)	0.02
541888:							
Atkins	85	Fair		Poor		Poor	
		Low content of organic matter	0.12	Wetness	0.00	Wetness	0.00
		Too acid	0.50			Hard to reclaim (rock fragments)	0.32
						Too acid	0.88
541889:							
Berks	85	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Low content of organic matter	0.12			Depth to bedrock	0.84
		Too acid	0.50			Too acid	0.92
541892:							
Blairton	90	Fair		Poor		Poor	
		Droughty	0.01	Depth to bedrock	0.00	Rock fragments	0.00
		Low content of organic matter	0.12	Wetness	0.29	Depth to bedrock	0.21
		Depth to bedrock	0.21			Wetness	0.29
541896:							
Brinkerton	90	Fair		Poor		Poor	
		Low content of organic matter	0.12	Wetness	0.00	Wetness	0.00
		Too acid	0.54	Shrink-swell	0.99	Hard to reclaim (rock fragments)	0.00
		Water erosion	0.99			Too acid	0.98
541900:							
Cavode	85	Fair		Poor		Fair	
		Too clayey	0.18	Low strength	0.00	Wetness	0.01
		Too acid	0.32	Wetness	0.01	Too clayey	0.12
		Low content of organic matter	0.50	Shrink-swell	0.87	Hard to reclaim (rock fragments)	0.24
541903:							
Cookport	65	Fair		Fair		Poor	
		Too acid	0.12	Wetness	0.53	Rock fragments	0.00
		Low content of organic matter	0.12			Wetness	0.53
						Too acid	0.88
Ernest	25	Fair		Fair		Fair	
		Low content of organic matter	0.12	Wetness	0.06	Wetness	0.06
		Too acid	0.32	Low strength	0.22	Hard to reclaim (rock fragments)	0.88
		Water erosion	0.90	Shrink-swell	0.98	Rock fragments	0.88

Table 12.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
541904:							
Cookport	70	Fair		Fair		Poor	
		Too acid	0.12	Wetness	0.53	Rock fragments	0.00
		Low content of organic matter	0.12			Slope	0.37
						Wetness	0.53
Ernest	25	Fair		Fair		Fair	
		Low content of organic matter	0.12	Wetness	0.06	Wetness	0.06
				Low strength	0.22	Slope	0.37
		Too acid	0.32	Shrink-swell	0.98	Hard to reclaim (rock fragments)	0.88
		Water erosion	0.90				
541907:							
Cookport	70	Fair		Poor		Poor	
		Too acid	0.12	Wetness	0.00	Wetness	0.00
		Low content of organic matter	0.13	Slope	0.92	Slope	0.00
				Dusty	0.99	Rock fragments	0.33
Ernest	25	Fair		Fair		Poor	
		Low content of organic matter	0.13	Wetness	0.06	Slope	0.00
				Low strength	0.22	Wetness	0.06
		Too acid	0.32	Dusty	0.82	Rock fragments	0.37
541915:							
Gilpin	70	Fair		Poor		Poor	
		Low content of organic matter	0.12	Depth to bedrock	0.00	Slope	0.00
				Slope	0.50	Rock fragments	0.00
		Too acid	0.50			Too acid	0.59
		Droughty	0.81				
Rayne	30	Fair		Fair		Poor	
		Low content of organic matter	0.12	Slope	0.50	Slope	0.00
						Rock fragments	0.00
		Too acid	0.32			Hard to reclaim (rock fragments)	0.00
541925:							
Laidig	100	Fair		Poor		Poor	
		Too acid	0.12	Slope	0.00	Slope	0.00
		Low content of organic matter	0.12	Wetness	0.89	Rock fragments	0.00
						Hard to reclaim (rock fragments)	0.50
541933:							
Philo	90	Fair		Fair		Fair	
		Low content of organic matter	0.12	Wetness	0.29	Hard to reclaim (rock fragments)	0.02
		Too acid	0.54			Wetness	0.29
		Water erosion	0.99			Rock fragments	0.76
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Poor		Poor		Poor	
		Droughty	0.00	Cobble content	0.00	Hard to reclaim (rock fragments)	0.00
		Cobble content	0.00			Rock fragments	0.00
		Low content of organic matter	0.12			Slope	0.37
541942:							
Water	100	Not rated		Not rated		Not rated	

Table 12.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
541943:							
Wharton	80	Fair		Poor		Poor	
		Low content of organic matter	0.12	Low strength	0.00	Hard to reclaim (rock fragments)	0.00
		Too acid	0.20	Wetness	0.76	Wetness	0.76
		Water erosion	0.99	Shrink-swell	0.87	Too acid	0.76

Table 13.—Ponds and Embankments

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
541887:							
Armagh	85	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.08	Depth to saturated zone	1.00	Slow refill	0.28
		Seepage	0.02	Piping	0.30	Unstable excavation walls	0.10
541888:							
Atkins	85	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Depth to saturated zone	1.00	Unstable excavation walls	0.10
				Piping	1.00		
541889:							
Berks	85	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.74	Depth to water	1.00
		Depth to bedrock	0.74				
		Slope	0.68				
541892:							
Blairton	90	Somewhat limited		Very limited		Very limited	
		Depth to bedrock	0.95	Depth to saturated zone	1.00	Depth to water	1.00
		Slope	0.68	Piping	1.00		
		Seepage	0.54	Thin layer	0.95		
541896:							
Brinkerton	90	Somewhat limited		Very limited		Very limited	
		Seepage	0.72	Depth to saturated zone	1.00	Depth to water	1.00
		Slope	0.08	Piping	0.99		
541900:							
Cavode	85	Very limited		Very limited		Somewhat limited	
		Slope	1.00	Depth to saturated zone	1.00	Slow refill	0.93
		Seepage	0.07	Piping	0.94	Unstable excavation walls	0.50
						Depth to hard bedrock	0.02
541903:							
Cookport	65	Somewhat limited		Very limited		Very limited	
		Seepage	0.72	Depth to saturated zone	1.00	Depth to water	1.00
		Slope	0.68	Piping	1.00		
Ernest	25	Somewhat limited		Very limited		Very limited	
		Seepage	0.72	Depth to saturated zone	1.00	Depth to water	1.00
		Slope	0.68	Piping	0.86		

Table 13.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
541904:							
Cookport	70	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to water	1.00
		Seepage	0.72	Piping	1.00		
Ernest	25	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to water	1.00
		Seepage	0.72	Piping	0.86		
541907:							
Cookport	70	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to water	1.00
		Seepage	0.72	Piping	0.99		
				Dusty	0.02		
Ernest	25	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to water	1.00
		Seepage	0.72	Piping	0.81		
				Dusty	0.04		
541915:							
Gilpin	70	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.72	Thin layer	0.58		
		Depth to bedrock	0.57				
Rayne	30	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.72				
541925:							
Laidig	100	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.86	Depth to water	1.00
		Seepage	1.00				
541933:							
Philo	90	Very limited		Very limited		Very limited	
		Seepage	1.00	Depth to saturated zone	1.00	Unstable excavation walls	1.00
541941:							
Urban land	60	Not rated		Not rated		Not rated	
Udorthents	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	1.00	Large stones	1.00		
541942:							
Water	100	Not rated		Not rated		Not rated	
541943:							
Wharton	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.68	Depth to saturated zone	0.95	Depth to water	1.00
		Seepage	0.02	Piping	0.50		

Table 14.—Engineering Properties

(Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 in	Fragments: 3-10 in	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
541887:												
Armagh----------	0-12	Silt loam	ML	A-6, A-4	0	0-5	95-100	90-100	80-95	75-85	27-49	9-22
	12-48	Silty clay loam, silty clay, channery clay	ML, MH, CL	A-7, A-6, A-4	0	0-5	80-95	65-90	60-85	55-85	35-55	9-25
	48-60	Silty clay, channery clay loam, very channery silty clay loam	SC, SM, GC, GM	A-6, A-7, A-2, A-4	0	0-40	55-90	20-85	15-60	15-45	30-45	9-18
541888:												
Atkins----------	0-9	Silt loam	ML, CL-ML, CL	A-6, A-4	0	0	89-100	75-100	67-100	58-90	20-40	3-20
	9-36	Silty clay loam, silt loam, sandy loam	ML, CL	A-6, A-4	0	0-5	89-100	75-100	67-100	56-92	20-40	3-20
	36-64	Sandy loam, stratified gravelly sandy loam to silty clay loam, gravelly loam	ML, SM, CL, GM	A-6, A-4, A-2	0	0-14	67-100	34-100	20-80	15-50	20-40	1-15
541889:												
Berks----------	0-7	Channery silt loam	ML, SC, GC, GM	A-4, A-2	0	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	7-29	Very channery silt loam, very channery loam, channery silt loam	SC, SM, GC, GM	A-4, A-2, A-1	0	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	29-34	Extremely channery silt loam, very channery loam, channery loam	SM, GM	A-2, A-1	0	0-40	35-65	10-55	10-40	10-35	24-38	2-10
	34-38	Bedrock	---	---	---	---	---	---	---	---	---	---
541892:												
Blairton--------	0-9	Silt loam	ML, CL-ML	A-4	0	0	80-100	75-100	65-90	50-80	20-35	2-10
	9-22	Silt loam, channery silty clay loam, very channery loam	ML, GC, CL, GM	A-6, A-7, A-2, A-4	0	0-5	50-90	35-90	30-85	25-70	25-42	2-20
	22-26	Very channery loam, channery loam, very channery silt loam	ML, SM, CL, GM	A-4, A-6, A-1, A-2	0	0-10	15-65	15-65	15-65	10-60	25-40	2-12
	26-30	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 14.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 in	Fragments: 3-10 in	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
541896:												
Brinkerton------	0-7	Silt loam	ML	A-6, A-4	0	0-10	90-100	85-100	85-100	75-100	27-47	9-21
	7-28	Silty clay loam, silt loam	ML	A-6, A-7, A-4, A-5	0	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	28-41	Silt loam, channery loam, channery silty clay loam	ML	A-6, A-7, A-4, A-5	0	0-10	75-100	60-100	60-100	55-100	30-45	5-15
	41-60	Silt loam, channery loam, channery silt loam	SC, SM, CL, ML	A-4, A-6, A-1, A-2	0	0-50	70-90	25-85	25-85	20-75	30-40	5-15
541900:												
Cavode----------	0-10	Silty clay loam, silt loam	CL-ML, CL	A-4	0	0-17	85-100	85-100	74-100	65-95	20-40	4-15
	10-47	Clay, silty clay, silty clay loam	ML, CL-ML	A-7, A-6, A-4	0	0-15	83-100	82-100	70-100	65-100	25-50	4-20
	47-57	Channery silt loam, silty clay, channery silty clay loam	ML, GM	A-6, A-4	0-7	0-41	51-100	50-100	44-100	38-100	25-45	2-15
	57-61	Bedrock	---	---	---	---	---	---	---	---	---	---
541903:												
Cookport--------	0-14	Channery loam	SC, SM, CL, ML	A-6, A-4, A-2	0	0-15	75-100	60-70	50-60	30-55	20-40	1-15
	14-26	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	26-40	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	40-60	Channery sandy loam, channery loam	ML, SC-SM, CL, GC-GM	A-6, A-4, A-2	0	0-15	60-100	50-95	40-95	30-75	20-40	1-15
	60-62	Bedrock	---	---	---	---	---	---	---	---	---	---
Ernest----------	0-8	Silt loam	ML, CL-ML, CL	A-6, A-4	0	0-10	85-100	80-100	70-95	60-95	20-40	4-15
	8-26	Silty clay loam, silt loam, channery silt loam	ML, CL-ML, CL	A-7, A-6, A-4	0	0-15	75-95	70-95	65-90	55-90	25-50	6-22
	26-41	Channery silt loam, channery loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	41-61	Channery silt loam, silt loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0	0-20	70-95	45-95	45-90	40-90	25-50	6-22

Table 14.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 in	Fragments: 3-10 in	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
541904:												
Cookport--------	0-14	Channery loam	SC, SM, CL, ML	A-6, A-4, A-2	0	0-15	75-100	60-70	50-60	30-55	20-40	1-15
	14-26	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	26-40	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	40-60	Channery sandy loam, channery loam	ML, SC-SM, CL, GC-GM	A-6, A-4, A-2	0	0-15	60-100	50-95	40-95	30-75	20-40	1-15
	60-62	Bedrock	---	---	---	---	---	---	---	---	---	---
Ernest----------	0-8	Silt loam	ML, CL-ML, CL	A-6, A-4	0	0-10	85-100	80-100	70-95	60-95	20-40	4-15
	8-26	Silty clay loam, silt loam, channery silt loam	ML, CL-ML, CL	A-7, A-6, A-4	0	0-15	75-95	70-95	65-90	55-90	25-50	6-22
	26-41	Channery silt loam, channery loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	41-61	Channery silt loam, silt loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0	0-20	70-95	45-95	45-90	40-90	25-50	6-22
541907:												
Cookport--------	0-10	Channery loam	SC, SM, CL, ML	A-6, A-4, A-2	0-5	2-40	75-95	60-70	50-60	30-55	20-40	1-15
	10-26	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	26-40	Sandy clay loam, clay loam, channery loam	SC, SM, CL, ML	A-6, A-4	0	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	40-60	Channery sandy loam, channery loam	ML, SC-SM, CL, GC-GM	A-6, A-4, A-2	0-2	0-15	60-100	50-95	40-95	30-75	20-40	1-15
	60-62	Bedrock	---	---	---	---	---	---	---	---	---	---
Ernest----------	0-8	Channery silt loam	ML, CL-ML, CL	A-6, A-4	0-5	3-15	65-80	60-80	55-75	55-70	20-40	4-15
	8-26	Silty clay loam, silt loam, channery silt loam	ML, CL-ML, CL	A-7, A-6, A-4	0	0-15	75-95	70-95	65-90	55-90	25-50	6-22
	26-41	Channery silt loam, channery loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	41-61	Channery silt loam, silt loam, silty clay loam	ML, SC, CL, GM	A-7, A-6, A-4	0-2	0-20	70-95	45-95	45-90	40-90	25-50	6-22

Table 14.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 in	Fragments: 3-10 in	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
541915:												
Gilpin----------	0-10	Silt loam	CL-ML, CL	A-6, A-4	0	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	10-28	Channery silty clay loam, channery silt loam, silty clay loam	GC, SC, CL, CL-ML	A-6, A-4, A-2	0	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	28-38	Channery loam, very channery silt loam, very channery silty clay loam	GC-GM, GC	A-6, A-4, A-2-4	0	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	38-42	Bedrock	---	---	---	---	---	---	---	---	---	---
Rayne----------	0-8	Silt loam	ML, CL	A-6, A-4	0	0-5	85-100	80-100	70-85	60-80	22-43	6-18
	8-40	Loam, channery silty clay loam, channery clay loam	GM, ML, SC, GC	A-6, A-4, A-2	0	0-15	60-95	55-85	40-85	30-60	20-40	2-15
	40-60	Channery sandy loam, channery silt loam, very channery silty clay loam	ML, SM, GM, GP-GM	A-4, A-2-4, A-1	0	0-35	40-90	15-80	15-75	10-60	20-35	NP-10
	60-64	Bedrock	---	---	---	---	---	---	---	---	---	---
541925:												
Laidig----------	0-7	Channery loam	ML, SM, CL, GM	A-4	0	0-5	65-90	50-80	45-80	35-70	15-30	1-10
	7-36	Channery loam, channery sandy clay loam, channery sandy loam	SC, SM, CL, ML	A-6, A-4, A-2	0	5-20	70-95	50-90	40-80	20-70	15-40	2-18
	36-50	Very channery sandy loam, channery sandy clay loam, very channery loam, channery sandy loam	GC-GM, SC, CL-ML, GC	A-6, A-4, A-2	0	5-20	50-90	40-85	30-80	15-70	15-35	2-16
	50-65	Channery sandy clay loam, very channery loam, channery sandy loam	GC-GM, SC, CL-ML, GC	A-6, A-4, A-2	0	5-20	50-90	40-85	30-80	15-70	15-35	2-16
541933:												
Philo----------	0-10	Silt loam	ML, CL-ML	A-4	0	0-5	95-100	74-100	66-99	53-81	20-35	1-10
	10-40	Silt loam, loam, sandy loam, fine sandy loam	ML, CL-ML	A-4	0	0-5	95-100	70-100	62-99	50-81	20-35	1-10
	40-65	Gravelly loam, silt loam, gravelly sandy loam	ML, SC-SM, CL-ML, GM	A-4, A-1-b	0-5	0-26	65-94	25-94	17-79	10-51	15-30	1-10

Table 14.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 in	Fragments: 3-10 in	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
541941:												
Udorthents------	0-6	Very channery silt loam	GM, SC-SM, CL, GC	A-4, A-2, A-1	0	30-60	40-80	30-70	20-65	15-60	15-25	NP-10
	6-60	Very channery silt loam, very channery sandy loam, very channery loam	GW-GM, SC-SM, GC, GM	A-2-4, A-1	0	40-70	25-80	20-50	10-30	5-30	15-40	NP-15
541943:												
Wharton---------	0-7	Silt loam	ML, CL	A-6, A-4	0	0-5	95-100	90-100	80-95	70-90	27-43	9-17
	7-44	Clay loam, channery silty clay loam, channery silt loam	ML, CL	A-7, A-6	0	0-25	75-100	70-100	65-95	60-90	35-45	10-25
	44-60	Silt loam, channery clay, very channery silty clay loam	SM, ML, GM	A-6, A-7, A-2, A-4	0	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	60-70	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 15.—Physical Soil Properties

(Sand, silt, and clay values are shown either as a range or as a representative value. Absence of an entry indicates that data were not estimated. Soil properties are measured or inferred from direct observations in the field or laboratory)

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
541887:									
Armagh----------	0-12	24	52	15-32	1.20-1.40	0.6-2.0	0.18-0.22	0.0-2.9	1.0-4.0
	12-48	7	54	35-55	1.30-1.60	0.1-0.2	0.10-0.14	3.0-5.9	0.0-0.5
	48-60	9	56	15-55	1.20-1.60	0.1-0.6	0.08-0.12	3.0-5.9	0.0-0.5
541888:									
Atkins----------	0-9	21	55	18-30	1.20-1.40	0.6-2.0	0.14-0.22	0.0-2.9	2.0-4.0
	9-36	25	51	18-35	1.20-1.50	0.1-2.0	0.14-0.18	0.0-2.9	0.0-0.5
	36-64	45	37	10-35	1.20-1.50	0.2-6.0	0.08-0.18	0.0-2.9	0.0-0.5
541889:									
Berks----------	0-7	30	56	5-23	1.20-1.50	0.6-6.0	0.08-0.12	0.0-2.9	0.5-3.0
	7-29	27	54	5-32	1.20-1.60	0.6-6.0	0.04-0.10	0.0-2.9	0.0-0.5
	29-34	38	52	5-20	1.20-1.60	2.0-6.0	0.04-0.10	0.0-2.9	0.0-0.5
	34-38	---	---	---	---	---	---	---	---
541892:									
Blairton--------	0-9	27	54	10-27	1.40-1.60	0.6-2.0	0.14-0.18	0.0-2.9	1.0-4.0
	9-22	18	54	18-35	1.50-1.70	0.2-0.6	0.08-0.14	0.0-2.9	0.0-0.5
	22-26	43	38	10-27	1.40-1.60	0.2-2.0	0.04-0.10	0.0-2.9	0.0-0.5
	26-30	---	---	---	---	---	---	---	---
541896:									
Brinkerton------	0-7	7	70	15-30	1.20-1.40	0.6-2.0	0.18-0.24	0.0-2.9	1.0-4.0
	7-28	7	64	15-35	1.20-1.50	0.6-2.0	0.14-0.18	3.0-5.9	0.0-0.5
	28-41	7	65	15-35	1.40-1.70	0.1-0.2	0.08-0.12	3.0-5.9	0.0-0.5
	41-60	11	69	15-25	1.20-1.55	0.1-0.6	0.14-0.18	0.0-2.9	0.0-0.5
541900:									
Cavode----------	0-10	13-25	45-70	15-34	1.20-1.40	0.6-2.0	0.18-0.22	0.0-2.9	2.0-4.0
	10-47	1-27	30-70	24-69	1.20-1.50	0.1-0.2	0.10-0.14	3.0-5.9	0.1-1.0
	47-57	2-45	35-65	18-50	1.20-1.50	0.1-0.2	0.08-0.12	3.0-5.9	0.0-0.5
	57-61	---	---	---	---	0.1-2.0	---	---	---
541903:									
Cookport--------	0-14	43	38	10-27	1.20-1.40	0.6-2.0	0.12-0.16	0.0-2.9	1.0-4.0
	14-26	38	36	18-35	1.20-1.50	0.6-2.0	0.12-0.16	0.0-2.9	0.0-0.5
	26-40	38	36	18-35	1.40-1.70	0.1-0.2	0.08-0.12	0.0-2.9	0.0-0.5
	40-60	66	15	10-27	1.20-1.50	0.2-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	60-62	---	---	---	---	---	---	---	---

Table 15.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
541903:									
Ernest----------	0-8	29	53	15-20	1.20-1.40	0.6-2.0	0.14-0.20	0.0-2.9	2.0-4.0
	8-26	18	54	20-35	1.30-1.50	0.6-2.0	0.12-0.16	3.0-5.9	0.0-0.5
	26-41	21	55	18-30	1.40-1.70	0.1-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	41-61	18	55	20-35	1.30-1.60	0.1-0.6	0.08-0.12	3.0-5.9	0.0-0.5
541904:									
Cookport--------	0-14	43	38	10-27	1.20-1.40	0.6-2.0	0.12-0.16	0.0-2.9	1.0-4.0
	14-26	38	36	18-35	1.20-1.50	0.6-2.0	0.12-0.16	0.0-2.9	0.0-0.5
	26-40	38	36	18-35	1.40-1.70	0.1-0.2	0.08-0.12	0.0-2.9	0.0-0.5
	40-60	66	15	10-27	1.20-1.50	0.2-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	60-62	---	---	---	---	---	---	---	---
Ernest----------	0-8	29	53	15-20	1.20-1.40	0.6-2.0	0.14-0.20	0.0-2.9	2.0-4.0
	8-26	18	54	20-35	1.30-1.50	0.6-2.0	0.12-0.16	3.0-5.9	0.0-0.5
	26-41	21	55	18-30	1.40-1.70	0.1-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	41-61	18	55	20-35	1.30-1.60	0.1-0.6	0.08-0.12	3.0-5.9	0.0-0.5
541907:									
Cookport--------	0-10	43	38	10-27	1.20-1.40	0.6-2.0	0.12-0.16	0.0-2.9	1.0-5.0
	10-26	38	36	18-35	1.20-1.50	0.6-2.0	0.12-0.16	0.0-2.9	0.0-0.5
	26-40	38	36	18-35	1.40-1.70	0.1-0.2	0.08-0.12	0.0-2.9	0.0-0.5
	40-60	66	15	10-27	1.20-1.50	0.2-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	60-62	---	---	---	---	---	---	---	---
Ernest----------	0-8	29	53	15-20	1.20-1.40	0.6-2.0	0.12-0.18	0.0-2.9	2.0-5.0
	8-26	18	54	20-35	1.30-1.50	0.6-2.0	0.12-0.16	3.0-5.9	0.0-0.5
	26-41	21	55	18-30	1.40-1.70	0.1-0.6	0.08-0.12	0.0-2.9	0.0-0.5
	41-61	18	55	20-35	1.30-1.60	0.1-0.6	0.08-0.12	3.0-5.9	0.0-0.5
541915:									
Gilpin----------	0-10	26	53	15-27	1.20-1.40	0.6-2.0	0.12-0.18	0.0-2.9	0.5-4.0
	10-28	18	54	18-35	1.20-1.50	0.6-2.0	0.12-0.16	0.0-2.9	0.0-0.5
	28-38	20	54	15-35	1.20-1.50	0.6-2.0	0.08-0.12	0.0-2.9	0.0-0.5
	38-42	---	---	---	---	---	---	---	---
Rayne----------	0-8	27	54	10-27	1.20-1.40	0.6-2.0	0.14-0.18	0.0-2.9	1.0-3.0
	8-40	18	54	18-35	1.40-1.60	0.6-2.0	0.12-0.16	0.0-2.9	0.0-0.5
	40-60	18	54	10-30	1.40-1.60	0.6-2.0	0.10-0.16	0.0-2.9	0.0-0.5
	60-64	---	---	---	---	---	---	---	---
541925:									
Laidig----------	0-7	43	38	10-27	1.20-1.40	0.6-6.0	0.10-0.14	0.0-2.9	1.0-4.0
	7-36	38	36	18-35	1.30-1.50	0.6-6.0	0.08-0.12	0.0-2.9	0.0-0.5
	36-50	60	20	18-35	1.30-1.60	0.1-0.6	0.06-0.10	0.0-2.9	0.0-0.5
	50-65	60	20	18-35	1.30-1.60	0.1-0.6	0.06-0.10	0.0-2.9	0.0-0.5

Table 15.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
541933:									
Philo----------	0-10	15-40	50-80	10-20	1.20-1.40	0.6-2.0	0.14-0.20	0.0-2.9	2.0-4.0
	10-40	15-65	30-70	10-20	1.30-1.50	0.6-2.0	0.10-0.20	0.0-2.9	0.0-0.5
	40-65	15-65	20-70	5-20	1.20-1.50	2.0-6.0	0.06-0.10	0.0-2.9	0.0-0.5
541941:									
Udorthents------	0-6	29	53	8-27	1.20-1.50	2.0-6.0	0.01-0.04	0.0-2.9	0.5-1.0
	6-60	18	56	6-50	1.30-1.60	2.0-20.0	0.01-0.05	0.0-2.9	0.0-0.5
541943:									
Wharton---------	0-7	26	54	15-25	1.10-1.30	0.6-2.0	0.16-0.20	0.0-2.9	1.0-4.0
	7-44	18	54	15-35	1.20-1.50	0.1-0.6	0.12-0.16	3.0-5.9	0.0-0.5
	44-60	18	50	20-45	1.20-1.60	0.1-0.6	0.08-0.12	3.0-5.9	0.0-0.5
	60-70	---	---	---	---	0.0-2.0	---	---	---

Table 16.—Erosion Properties

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map unit symbol and soil name	Depth (inches)	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
541887:						
Armagh	0-12	.24	.24	5	5	56
	12-48	.28	.24			
	48-60	.17	.32			
541888:						
Atkins	0-9	.32	.32	5	8	0
	9-36	.32	.32			
	36-64	.28	.32			
541889:						
Berks	0-7	.17	.32	3	6	48
	7-29	.17	.24			
	29-34	.17	.24			
	34-38	---	---			
541892:						
Blairton	0-9	.43	.43	3	5	56
	9-22	.32	.37			
	22-26	.32	.43			
	26-30	---	---			
541896:						
Brinkerton	0-7	.32	.32	3	5	56
	7-28	.37	.37			
	28-41	.32	.32			
	41-60	.20	.24			
541900:						
Cavode	0-10	.37	.37	4	6	48
	10-47	.24	.32			
	47-57	.24	.32			
	57-61	---	---			
541903:						
Cookport	0-14	.24	.24	3	5	56
	14-26	.24	.24			
	26-40	.24	.24			
	40-60	.24	.24			
	60-62	---	---			
Ernest	0-8	.43	.43	3	5	56
	8-26	.32	.32			
	26-41	.32	.32			
	41-61	.32	.32			
541904:						
Cookport	0-14	.24	.24	3	5	56
	14-26	.24	.24			
	26-40	.24	.24			
	40-60	.24	.24			
	60-62	---	---			
Ernest	0-8	.43	.43	3	5	56
	8-26	.32	.32			
	26-41	.32	.32			
	41-61	.32	.32			

Table 16.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (inches)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
541907:						
Cookport	0-10	.24	.24	3	8	0
	10-26	.24	.24			
	26-40	.24	.24			
	40-60	.24	.24			
	60-62	---	---			
Ernest	0-8	.32	.43	3	8	0
	8-26	.32	.32			
	26-41	.32	.32			
	41-61	.32	.32			
541915:						
Gilpin	0-10	.32	.32	3	5	56
	10-28	.24	.32			
	28-38	.24	.32			
	38-42	---	---			
Rayne	0-8	.28	.32	4	5	56
	8-40	.20	.24			
	40-60	.20	.24			
	60-64	---	---			
541925:						
Laidig	0-7	.28	.28	4	5	56
	7-36	.24	.24			
	36-50	.17	.24			
	50-65	.17	.24			
541933:						
Philo	0-10	.37	.37	5	5	56
	10-40	.32	.32			
	40-65	.24	.28			
541941:						
Urban land.						
Udorthents	0-6	.10	.24	5	5	56
	6-60	.10	.24			
541942.						
Water						
541943:						
Wharton	0-7	.37	.37	4	5	56
	7-44	.24	.28			
	44-60	.17	.24			
	60-70	---	---			

Table 17.—Total Soil Carbon

(This table displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a depth of 2 meters or to the representative top depth of any kind of bedrock or any cemented soil horizon. SOC and SIC are reported on a volumetric whole soil basis, corrected for representative rock fragments indicated in the database. SOC is converted from horizon soil organic matter of the fraction of the soil less than 2 mm in diameter. If soil organic matter indicated in the database is NULL, SOC is assumed to be zero. SIC is converted from horizon calcium carbonate content fraction of the soil less than 2 mm in diameter. If horizon calcium carbonate indicated in the database is NULL, SIC is assumed to be zero. A weighted average of all horizons is used in the calculations. Only major components of a map unit are displayed in this table)

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
541887:		
Armagh (85%)	7	0
541888:		
Atkins (85%)	7	0
541889:		
Berks (85%)	3	0
541892:		
Blairton (90%)	5	0
541896:		
Brinkerton (90%)	5	0
541900:		
Cavode (85%)	9	0
541903:		
Cookport (65%)	7	0
Ernest (25%)	6	0
541904:		
Cookport (70%)	7	0
Ernest (25%)	6	0
541904:		
Cookport (70%)	6	0
Ernest (25%)	6	0
541915:		
Gilpin (70%)	5	0
Rayne (30%)	5	0
541925:		
Laidig (100%)	5	0
541933:		
Philo (90%)	7	0

Table 17.—Total Soil Carbon—Continued

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
541941:		
Urban land (60%)		
Udorthents (30%)	1	0
541942.		
Water (100%)		
541943:		
Wharton (80%)	5	0

Table 18.—Chemical Soil Properties

(Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	In	meq/100 g	meq/100 g	pH
541887:				
Armagh	0-12	---	3.8-9.4	4.5-5.5
	12-48	---	7.0-11.0	4.5-5.5
	48-60	---	3.0-11.0	4.5-5.5
541888:				
Atkins	0-9	15.0-26.0	5.1-9.0	4.5-5.5
	9-36	6.0-20.0	3.6-7.0	4.5-5.5
	36-64	4.0-20.0	2.0-7.0	4.5-5.5
541889:				
Berks	0-7	5.0-15.0	---	5.1-6.5
	7-29	5.0-10.0	1.0-6.8	3.6-6.5
	29-34	5.0-10.0	1.0-4.4	3.6-6.5
	34-38	---	---	---
541892:				
Blairton	0-9	---	2.8-8.4	4.2-6.6
	9-22	---	3.6-7.0	3.6-5.5
	22-26	---	2.0-5.4	3.6-5.5
	26-30	---	---	---
541896:				
Brinkerton	0-7	---	3.8-9.0	4.5-6.0
	7-28	---	3.0-7.0	4.5-6.0
	28-41	---	3.0-7.0	4.5-6.0
	41-60	10.9-19.7	---	5.1-6.5
541900:				
Cavode	0-10	8.2-18.5	---	4.8-6.2
	10-47	---	7.3-32.2	4.5-5.5
	47-57	---	5.7-27.2	4.5-5.5
	57-61	---	---	---
541903:				
Cookport	0-14	---	2.8-8.4	4.5-5.5
	14-26	---	3.6-7.0	3.6-5.5
	26-40	---	3.6-7.0	3.6-5.5
	40-60	---	2.0-5.4	3.6-5.5
	60-62	---	---	---
Ernest	0-8	---	4.5-7.0	4.5-6.0
	8-26	---	4.0-7.0	4.5-5.5
	26-41	---	3.6-6.0	4.5-5.5
	41-61	---	4.0-7.0	4.5-5.5
541904:				
Cookport	0-14	---	2.8-8.4	4.5-5.5
	14-26	---	3.6-7.0	3.6-5.5
	26-40	---	3.6-7.0	3.6-5.5
	40-60	---	2.0-5.4	3.6-5.5
	60-62	---	---	---
Ernest	0-8	---	4.5-7.0	4.5-6.0
	8-26	---	4.0-7.0	4.5-5.5
	26-41	---	3.6-6.0	4.5-5.5
	41-61	---	4.0-7.0	4.5-5.5

Table 18.—Chemical Soil Properties—Continued

Map unit symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	In	meq/100 g	meq/100 g	pH
541907:				
Cookport	0-10	---	2.0-5.4	4.5-5.5
	10-26	---	3.6-7.0	3.6-5.5
	26-40	---	3.6-7.0	3.6-5.5
	40-60	---	2.0-5.4	3.6-5.5
	60-62	---	---	---
Ernest	0-8	---	3.0-4.0	4.5-6.0
	8-26	---	4.0-7.0	4.5-5.5
	26-41	---	3.6-6.0	4.5-5.5
	41-61	---	4.0-7.0	4.5-5.5
541915:				
Gilpin	0-10	---	3.4-8.4	3.6-5.5
	10-28	---	3.6-7.0	3.6-5.5
	28-38	---	3.0-7.0	3.6-5.5
	38-42	---	---	---
Rayne	0-8	---	2.8-7.7	4.5-5.5
	8-40	---	3.6-7.0	4.5-5.5
	40-60	---	2.0-6.0	4.5-5.5
	60-64	---	---	---
541925:				
Laidig	0-7	---	2.8-8.4	3.6-5.5
	7-36	---	3.6-7.0	3.6-5.5
	36-50	---	3.6-7.0	3.6-5.5
	50-65	---	3.6-7.0	3.6-5.5
541933:				
Philo	0-10	5.5-11.0	---	5.1-6.5
	10-40	---	2.9-9.5	4.5-6.0
	40-65	---	1.3-9.5	4.5-6.0
541941:				
Udorthents	0-6	6.1-18.5	---	4.5-8.4
	6-60	3.6-30.0	---	4.5-8.4
541943:				
Wharton	0-7	---	3.8-8.0	4.0-5.5
	7-44	---	3.0-7.0	4.0-5.5
	44-60	---	4.0-9.0	4.0-5.5
	60-70	---	---	---

Table 19.—Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated. Depth to water table is based on a representative value)

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
541887:									
Armagh	D								
		January	0.3	>6.0	---	---	None	---	None
		February	0.3	>6.0	---	---	None	---	None
		March	0.3	>6.0	---	---	None	---	None
		April	0.3	>6.0	---	---	None	---	None
		May	0.3	>6.0	---	---	None	---	None
		June	0.3	>6.0	---	---	None	---	None
		October	0.3	>6.0	---	---	None	---	None
		November	0.3	>6.0	---	---	None	---	None
		December	0.3	>6.0	---	---	None	---	None
541888:									
Atkins	B/D								
		January	0.5	>6.0	---	---	None	Very brief	Frequent
		February	0.5	>6.0	---	---	None	Very brief	Frequent
		March	0.5	>6.0	---	---	None	Very brief	Frequent
		April	0.5	>6.0	---	---	None	Very brief	Frequent
		May	0.5	>6.0	---	---	None	Very brief	Frequent
		June	0.5	>6.0	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
		November	0.5	>6.0	---	---	None	Very brief	Frequent
		December	0.5	>6.0	---	---	None	Very brief	Frequent
541889:									
Berks	C								
		Jan-Dec	---	---	---	---	None	---	None
541892:									
Blairton	C								
		January	1.7	2.2	---	---	None	---	None
		February	1.7	2.2	---	---	None	---	None
		March	1.7	2.2	---	---	None	---	None
		November	1.7	2.2	---	---	None	---	None
		December	1.7	2.2	---	---	None	---	None

Table 19.—Water Features—Continued

Map unit symbol and soil name	Hydro-logic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
541896:									
Brinkerton	D								
		January	0.3	2.3	---	---	None	---	None
		February	0.3	2.3	---	---	None	---	None
		March	0.3	2.3	---	---	None	---	None
		April	0.3	2.3	---	---	None	---	None
		May	0.3	2.3	---	---	None	---	None
		October	0.3	2.3	---	---	None	---	None
		November	0.3	2.3	---	---	None	---	None
		December	0.3	2.3	---	---	None	---	None
541900:									
Cavode	C/D								
		January	1.1	4.8	---	---	None	---	None
		February	1.1	4.8	---	---	None	---	None
		March	1.1	4.8	---	---	None	---	None
		April	1.1	4.8	---	---	None	---	None
		May	1.1	4.8	---	---	None	---	None
		October	1.1	4.8	---	---	None	---	None
		November	1.1	4.8	---	---	None	---	None
		December	1.1	4.8	---	---	None	---	None
541903:									
Cookport	C								
		January	2.0	2.2	---	---	None	---	None
		February	2.0	2.2	---	---	None	---	None
		March	2.0	2.2	---	---	None	---	None
		April	2.0	2.2	---	---	None	---	None
		December	2.0	2.2	---	---	None	---	None
Ernest	C								
		January	1.3	2.2	---	---	None	---	None
		February	1.3	2.2	---	---	None	---	None
		March	1.3	2.2	---	---	None	---	None
		April	1.3	2.2	---	---	None	---	None
		December	1.3	2.2	---	---	None	---	None
541904:									
Cookport	C								
		January	2.0	2.2	---	---	None	---	None
		February	2.0	2.2	---	---	None	---	None
		March	2.0	2.2	---	---	None	---	None
		April	2.0	2.2	---	---	None	---	None
		December	2.0	2.2	---	---	None	---	None

Table 19.—Water Features—Continued

Map unit symbol and soil name	Hydro-logic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
541904:									
Ernest	C								
		January	1.3	2.2	---	---	None	---	None
		February	1.3	2.2	---	---	None	---	None
		March	1.3	2.2	---	---	None	---	None
		April	1.3	2.2	---	---	None	---	None
		December	1.3	2.2	---	---	None	---	None
541907:									
Cookport	C								
		January	0.3	2.3	---	---	None	---	None
		February	0.3	2.3	---	---	None	---	None
		March	0.3	2.3	---	---	None	---	None
		April	0.3	2.3	---	---	None	---	None
		May	0.3	2.3	---	---	None	---	None
		October	0.3	2.3	---	---	None	---	None
		November	0.3	2.3	---	---	None	---	None
		December	0.3	2.3	---	---	None	---	None
Ernest	C								
		January	1.3	2.2	---	---	None	---	None
		February	1.3	2.2	---	---	None	---	None
		March	1.3	2.2	---	---	None	---	None
		April	1.3	2.2	---	---	None	---	None
		December	1.3	2.2	---	---	None	---	None
541915:									
Gilpin	C								
		Jan-Dec	---	---	---	---	None	---	None
Rayne	B								
		Jan-Dec	---	---	---	---	None	---	None
541925:									
Laidig	C								
		January	2.5	3.0	---	---	None	---	None
		February	2.5	3.0	---	---	None	---	None
		March	2.5	3.0	---	---	None	---	None
541933:									
Philo	B								
		January	1.7	>6.0	---	---	None	Very brief	Occasional
		February	1.7	>6.0	---	---	None	Very brief	Occasional
		March	1.7	>6.0	---	---	None	Very brief	Occasional
		April	1.7	>6.0	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		December	1.7	>6.0	---	---	None	Very brief	Occasional

Table 19.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
541941:									
Urban land.									
Udorthents	A								
		Jan-Dec	---	---	---	---	None	---	None
541942.									
Water									
541943:									
Wharton	C/D								
		January	2.3	4.6	---	---	None	---	None
		February	2.3	4.6	---	---	None	---	None
		March	2.3	4.6	---	---	None	---	None
		November	2.3	4.6	---	---	None	---	None
		December	2.3	4.6	---	---	None	---	None

Table 20.—Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		In	In				
541887:							
Armagh	Paralithic bedrock	48-72	---	Very strongly cemented	High	High	High
Cavode	Paralithic bedrock	40-72	---	---	High	High	High
Armagh, very stony	Paralithic bedrock	48-72	---	Strongly cemented	High	High	High
541888:							
Atkins	Lithic bedrock	60-99	---	Indurated	High	High	Moderate
Basher	---	---	---	---	High	Moderate	Moderate
Elkins	---	---	---	---	High	High	High
Philo	---	---	---	---	Moderate	Low	High
541889:							
Berks	Lithic bedrock	20-40	---	Very strongly cemented	Low	Low	High
Bedington	Lithic bedrock	40-72	---	---	Moderate	Low	High
Ernest	---	---	---	---	Moderate	Moderate	Moderate
Blairton	Paralithic bedrock	20-40	---	---	High	High	High
Weikert	Lithic bedrock	10-20	---	---	Moderate	Moderate	Moderate
541892:							
Blairton	Lithic bedrock	20-40	---	Very strongly cemented	High	High	High
Brinkerton	Fragipan	15-35	---	Noncemented	High	High	High
541896:							
Brinkerton	Fragipan	30	---	Noncemented	High	High	High
Ernest	Fragipan	20-36	---	Noncemented	Moderate	Moderate	Moderate

Table 20.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		In	In				
541900:							
Cavode	Lithic bedrock	40-90	---	Very strongly cemented	High	High	High
Gilpin	Lithic bedrock	20-40	---	Indurated	Moderate	Low	High
Brinkerton	Fragipan	15-30	12-36	Noncemented	High	High	High
541903:							
Cookport	Fragipan	28	---	Noncemented	Moderate	Moderate	Moderate
	Lithic bedrock	40-72	---	Indurated			
Ernest	Fragipan	17-36	---	Noncemented	Moderate	Moderate	Moderate
Brinkerton	Fragipan	30	---	Noncemented	High	High	High
541904:							
Cookport	Fragipan	28	---	Noncemented	Moderate	Moderate	Moderate
	Lithic bedrock	40-72	---	Indurated			
Ernest	Fragipan	17-36	---	Noncemented	Moderate	Moderate	Moderate
Brinkerton	Fragipan	30	---	Noncemented	High	High	High
541907:							
Cookport	Fragipan	28	---	Noncemented	Moderate	Moderate	Moderate
	Lithic bedrock	40-72	---	Indurated			
Ernest	Fragipan	17-36	---	Noncemented	Moderate	Moderate	Moderate
541915:							
Gilpin	Lithic bedrock	20-40	---	Very strongly cemented	Moderate	Low	High
Rayne	Lithic bedrock	40-72	---	Very strongly cemented	Moderate	Low	High
541925:							
Laidig	Fragipan	30-50	---	Noncemented	Moderate	Moderate	High
541933:							
Philo	---	---	---	---	Moderate	Low	High
Atkins	---	---	---	---	High	High	Moderate

Table 20.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		In	In				
541941:							
Urban land.							
Udorthents	---	---	---	---	Low	High	High
Wet spots	---	---	---	---	High	High	High
541942.							
Water							
541943:							
Wharton	Lithic bedrock	40-70	---	Very strongly cemented	High	High	High
Cavode	Lithic bedrock	40-72	---	---	High	High	High
Buchanan	---	---	---	---	Moderate	High	High
Hartleton	Lithic bedrock	40-60	---	Very strongly cemented	Moderate	Low	High
Brinkerton	Fragipan	30	---	Noncemented	High	High	High

Table 21.—Taxonomic Classification of the Soils

Soil name	Family or higher taxonomic class
Armagh	Clayey, mixed, active, mesic Typic Endoaquults
Atkins	Fine-loamy, mixed, active, acid, mesic Fluvaquentic Endoaquepts
Basher	Coarse-loamy, mixed, active, mesic Fluvaquentic Dystrudepts
Bedington	Fine-loamy, mixed, active, mesic Typic Hapludults
Berks	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
Blairton	Fine-loamy, mixed, mesic Aquic Hapludults
Blairton taxadjunct	Fine-loamy, mixed, active, mesic Aquic Hapludults
Brinkerton	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs
Buchanan	Fine-loamy, mixed, mesic Aquic Fragiudults
Cavode	Fine, mixed, active, mesic Aeric Endoaquults
Cookport	Fine-loamy, mixed, active, mesic Aquic Fragiudults
Elkins	Fine-silty, mixed, active, acid, mesic Humaqueptic Fluvaquents
Ernest	Fine-loamy, mixed, superactive, mesic Aquic Fragiudults
Gilpin	Fine-loamy, mixed, active, mesic Typic Hapludults
Hartleton	Loamy-skeletal, mixed, active, mesic Typic Hapludults
Laidig	Fine-loamy, siliceous, active, mesic Typic Fragiudults
Philo	Coarse-loamy, mixed, active, mesic Fluvaquentic Dystrudepts
Rayne	Fine-loamy, mixed, active, mesic Typic Hapludults
Udorthents	Udorthents
Weikert	Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
Wharton	Fine-loamy, mixed, active, mesic Aquic Hapludults

Table 22.—Soil Classification Key

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

```
ORDER
   Suborder
      Great Group
         Subgroup
            Series or Higher Category

ALFISOLS
   Aqualfs
      Fragiaqualfs
         Typic Fragiaqualfs
            Brinkerton--------------------Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs

ENTISOLS
   Aquents
      Fluvaquents
         Humaqueptic Fluvaquents
            Elkins------------------------Fine-silty, mixed, active, acid, mesic Humaqueptic
                                           Fluvaquents
   Orthents
      Udorthents
            Udorthents--------------------Udorthents

INCEPTISOLS
   Aquepts
      Endoaquepts
         Fluvaquentic Endoaquepts
            Atkins------------------------Fine-loamy, mixed, active, acid, mesic Fluvaquentic
                                           Endoaquepts
   Udepts
      Dystrudepts
         Lithic Dystrudepts
            Weikert-----------------------Loamy-skeletal, mixed, active, mesic Lithic Dystrudepts
         Fluvaquentic Dystrudepts
            Basher------------------------Coarse-loamy, mixed, active, mesic Fluvaquentic
                                           Dystrudepts
            Philo-------------------------Coarse-loamy, mixed, active, mesic Fluvaquentic
                                           Dystrudepts
         Typic Dystrudepts
            Berks-------------------------Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

ULTISOLS
   Aquults
      Endoaquults
         Typic Endoaquults
            Armagh------------------------Clayey, mixed, active, mesic Typic Endoaquults
         Aeric Endoaquults
            Cavode------------------------Fine, mixed, active, mesic Aeric Endoaquults
```

Table 22.—Soil Classification Key—Continued

```
ORDER
   Suborder
      Great Group
         Subgroup
            Series or Higher Category

ULTISOLS—Continued
   Udults
      Fragiudults
         Typic Fragiudults
            Laidig------------------------Fine-loamy, siliceous, active, mesic Typic Fragiudults
         Aquic Fragiudults
            Cookport----------------------Fine-loamy, mixed, active, mesic Aquic Fragiudults
            Buchanan----------------------Fine-loamy, mixed, active, mesic Aquic Fragiudults
            Ernest------------------------Fine-loamy, mixed, active, mesic Aquic Fragiudults
      Hapludults
         Typic Hapludults
            Gilpin------------------------Fine-loamy, mixed, active, mesic Typic Hapludults
            Rayne-------------------------Fine-loamy, mixed, active, mesic Typic Hapludults
            Bedington---------------------Fine-loamy, mixed, mesic Typic Hapludults
            Hartleton---------------------Loamy-skeletal, mixed, active, mesic Typic Hapludults
         Aquic Hapludults
            Blairton----------------------Fine-loamy, mixed, mesic Aquic Hapludults
           *Blairton----------------------Fine-loamy, mixed, active, mesic Aquic Hapludults
            Wharton-----------------------Fine-loamy, mixed, active, mesic Aquic Hapludults
```

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