Stantec Consulting Services Inc.
3052 Beaumont Circle, Lexington KY 40513

October 9, 2018
File: rpt_002_let_175567301
Revision 0

Tennessee Valley Authority (TVA)
1101 Market Street
Chattanooga, Tennessee 37402

RE: Unstable Areas Demonstration
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

1.0 PURPOSE

As described in 40 CFR § 257.64(a), an owner or operator of an existing CCR surface impoundment is required to demonstrate that the unit is not located in unstable areas unless the unit meets certain requirements. This letter documents Stantec's certification that Ash Pond 2 at the TVA Shawnee Fossil Plant (SHF) complies with the location restrictions for unstable areas in the EPA Final CCR Rule at 40 CFR § 257.64(a).

2.0 SUMMARY OF FINDINGS

The attached demonstration documents that Ash Pond 2 meets the requirements set forth 40 CFR § 257.64(a).

3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Don W. Fuller II, being a Professional Engineer in good standing in the State of Kentucky, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the TVA Shawnee Ash Pond 2 meets the requirements specified in 40 CFR § 257.64(a).

Re: **Unstable Areas Demonstration**
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

SIGNATURE _____ DATE 10/9/2018

ADDRESS: Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, Kentucky 40513-1703

TELEPHONE: (859) 422-3000

ATTACHMENTS: Unstable Areas Demonstration

STATE OF KENTUCKY
DON W. FULLER, II
19142
LICENSED PROFESSIONAL ENGINEER

Unstable Areas Demonstration

Ash Pond 2
Shawnee Fossil Plant
Paducah, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga Tennessee

Prepared by:
Stantec Consulting Services Inc.
Lexington, Kentucky

October 9, 2018
Revision 0

Table of Contents

LIST OF FIGURES

LIST OF APPENDICES

1.0 PROJECT BACKGROUND

On April 17, 2015, EPA published the "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities" final rule in the Federal Register. The Tennessee Valley Authority (TVA) contracted Stantec Consulting Services Inc. (Stantec) to evaluate Ash Pond 2 at the Shawnee Fossil Plant (SHF) regarding the requirements for the Unstable Areas Location Restriction as required by the EPA Final CCR Rule, 40 C.F.R. § 257.64.

As required by §257.64 of the EPA Final CCR Rule, an owner or operator of an existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit is required by October 17, 2018, to demonstrate that the unit is not located in an unstable area unless the owner or operator demonstrates that generally accepted good engineering practices have been incorporated into the design of the CCR unit to promote the geotechnical integrity of the unit in such a manner that structural components of the CCR unit will not be disrupted.

The Ash Pond 2 has been identified as a CCR surface impoundment on the SHF site. As defined by §257.53 of the EPA Final CCR Rule, the Ash Pond 2 is characterized as a, "…diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR."

The following factors have been considered to determine whether the Ash Pond 2 located at SHF is located in an unstable area:

- On-site or local soil conditions that may result in significant differential settling;
- On-site or local geologic or geomorphologic features; and
- On-site or local human-made features or events (both surface and subsurface).

2.0 UNIT DESCRIPTION

SHF is a coal-fired, electric-generating plant. The plant is located in McCracken County, Kentucky, along the south shore of the Ohio River near river mile 946 and just east of the confluence of Little Bayou Creek with the Ohio River.

Figure 1: Site Vicinity Map

Ash Pond 2 is located at the northwest corner of the plant. It is bordered on the north by the Ohio River and the west by Little Bayou Creek. Ash Pond 2 is formed by the Perimeter Dike along the east, north, and west and by the Consolidated Waste Dry Stack to the south. Ash Pond 2 encompasses approximately 100 acres.

The unit is considered an active CCR surface impoundment and currently receives sluiced bottom ash, stormwater, and process flows from the plant and Coal Yard Drainage Basin.

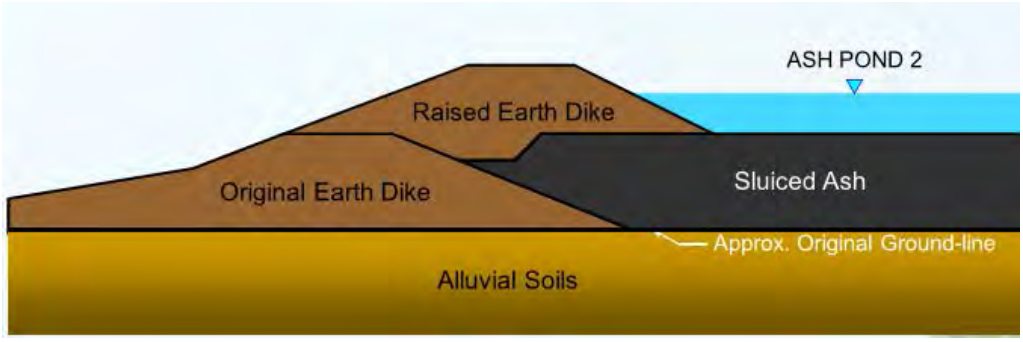


Figure 2: Typical Cross Section

The historical construction documents indicate the first phase of Ash Pond 2 began in 1970 consisting of dike construction along the north and west sides from the original grade to an elevation of 340 feet. The first phase was completed and put into service in 1971. The Upper Dike of Ash Pond 2 was raised 10 feet in 1979 using upstream construction methods to approximately elevation 351 feet. The dikes were constructed of compacted clay (Stantec Consulting Services Inc., 2016e). The soil borings from the 2010 geotechnical exploration reveal alluvial material directly below the dike system (Stantec Consulting Services Inc., 2010a). It should be noted that there were no construction record drawings, construction inspection reports, or quality control test results contained in the archived materials related to the original construction of Ash Pond 2 (Stantec Consulting Services Inc., 2016b).

3.0 SOIL CONDITIONS (§257.64(B)(1))

Per §257.64(b)(1), the unstable areas demonstration must consider on-site or local soil conditions that may result in significant differential settling when determining whether the area is unstable.

Assessment of the soil conditions was completed considering the following criteria related to the CCR Rule:

- Review inspection reports of the CCR unit for any documented deformations in the soils or movement of structural components indicating possible differential settlement of foundation soils.
- Review published soil surveys that indicate on-site or local presence of soft or compressible soil formation(s).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information that may indicate the foundation materials are soft or compressible.
- Review results of existing analyses to confirm that settlement of the unit would be negligible (within acceptable limits) and would not cause a release of CCR into the environment.

3.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the CCR Rule.

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) maintains an online web soil survey tool that outputs soils information for specific Areas of Interest. Appendix A includes the Web Soil Survey completed for the SHF Site.

According to available geologic data and soil surveys, Ash Pond 2 is located within the floodplain of the Ohio River within the Calloway-Henry soils association (United States Department of Agriculture Soil Conservation Service, 1976). Typically, the soils are silt loam over loamy clay and silt loams. The loess and Quaternary alluvial deposits primarily classify as CL and ML and associated dual symbols, and beneath those deposits are Plio-Pleistocene sands and gravels with varying silt content that primarily classify as SP, SM, GW, GM, and associated USCS dual symbols (FMSM, 2006).

The mapping describes the alluvium as consisting of clean fine sands to sandy clays and silts varying from about 0 to 40 feet in thickness. The underlying continental deposits consist of gravel and poorly sorted fine to coarse quartz and chert sand, exhibit cemented zones, vary from clean to clayey, and are locally micaceous. The Clayton and McNairy Formations consist of fine to medium quartz sand interbedded with black or brown clay that is commonly micaceous (Stantec Consulting Services Inc., 2010a).

The estimated engineering properties of the predominant soil series within the soils association indicate low shrink-swell potential and fair stability for embankments and dikes (United States Department of Agriculture Soil Conservation Service, 1976).

Geotechnical explorations indicate the clays and silts have strength consistencies ranging mostly from soft to very stiff based on SPT N-values and laboratory strength testing. Based on SPT N-values, the native sands and gravel have relative densities ranging mostly from medium dense to very dense with isolated very loose and loose zones (Stantec Consulting Services Inc., 2010a).

Stantec collected Shelby tube samples for one-dimensional consolidation testing to provide void ratios to aid in calculation of critical gradients to determine factors of safety against piping from the seepage analyses and to provide data for future settlement analyses, if performed during closure design (Stantec Consulting Services Inc., 2010a).

Site inspections of Ash Pond 2 have been conducted and documented regularly from 1971 to 2017. These inspections were reviewed for observations of potential signs of deformations in the soil or movement of structural components, which would indicate differential settlement of the foundation soils. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

3.2 ASSESSMENT

The 1976 Soil Survey of Ballard and McCracken Counties, Kentucky, was reviewed for evidence of soft and compressible soils that may have been on site prior to the development of the surface impoundment. For the purposes of this report, soft and compressible soils are fat clays, elastic silts, organic silts and clays, or highly organic soils (peat). These soil types have Unified Soil Classifications of CH, MH, OH, and PT. The information available from published soil surveys and the local soils described in Section 3.1 do not indicate the presence of soft or compressible soils within the surface impoundment foundation. The geotechnical explorations of Ash Pond 2 and subsequent analyses also show that the on-site foundation soils used for the surface impoundment are not considered soft or compressible. There was no indication of deformations in the soils or movement of structural components documented within the inspection reports pertaining to Ash Pond 2.

The results from the geotechnical exploration (Stantec Consulting Services Inc., 2010a) indicate that the upper and lower perimeter dike system for Ash Pond 2 is constructed of clay materials. The capacity of the pond was expanded by constructing the upper dikes inwardly over sluiced ash. The exploration program did confirm the presence of sluiced ash beneath the upper dike in the area of the divider dike that previously separated the ash pond and stilling pond within the Ash Pond 2 unit; however, since this area is on the interior portion of the unit, it does not impact the perimeter dike system stability or cause the unit to become unstable. For the current configuration of Ash Pond 2, the foundation soils conditions are stable and closure geometry embankment loading conditions are not anticipated to result in settlement that will impact the structural integrity of the facility.

UNSTABLE AREAS DEMONSTRATION – SHF ASH POND 2

Soil Conditions (§257.64(b)(1))
October 9, 2018

No indications of foundation issues (i.e. cracking, settlement, depressions, and/or deformation) were noted on historic inspection reports. Recent inspections of the Perimeter Dike, performed by Stantec (2010, 2011, 2014, and 2015) and O'Brien & Gere (O'Brien & Gere, 2013) note no significant signs of tension cracking, settlement, deformations or similar instabilities (Stantec Consulting Services Inc., 2016e).

Based on this assessment of the soil conditions, the CCR Rule-related criteria listed above for soil conditions have been met.

4.0 GEOLOGIC OR GEOMORPHOLOGIC FEATURES (§257.64(B)(2))

Per §257.64(b)(2), the unstable areas demonstration must consider on-site or local geologic or geomorphologic features when determining whether the area is unstable.

Assessment of the geologic or geomorphologic features was completed considering the following criteria related to the CCR Rule:

- Review of published geologic maps that indicate on-site or local geomorphologic features such as:
  - Karst potential;
  - Known sinkhole outlines;
  - Known spring locations; and,
  - Known landslide locations.
- Review of inspection reports of the CCR unit for any documented characteristic features of karstic formation (e.g. sinkholes, vertical shafts, sinking streams, caves, seeps, large springs, or blind valleys).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information regarding the on-site or local geology and geomorphology.
- Review of 5-foot and 10-meter Digital Elevation Models (DEMs) derived from LiDAR data obtained by the Kentucky Aerial Photography & Elevation Data (KYAPED) program and by the United States Geological Survey (USGS) to identify areas susceptible to mass movement.

4.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the CCR Rule. The University of Kentucky's Kentucky Geological Survey (KGS) maintains an interactive geologic map information service that provides valuable, relevant information and retrievable data about geologic or geomorphologic features in Kentucky. Appendix B contains a map presenting the geology of the area, a map locating nearby sinkholes, landslide locations, and springs, and two maps showing 5-foot and 10-meter DEMs show topography highlighting areas of shallow and steep slopes.

Ash Pond 2 is located in the northeastern part of the Mississippi embayment of the Gulf Coastal Plain Physiographic Province. The geologic setting may be described as a trough of Paleozoic rocks filled with unconsolidated sand and clay of Cretaceous and Eocene age, gravel of both Pliocene age, loess of Pleistocene age, and alluvium of Pleistocene and Recent age (MACTEC Engineering and Consulting, Inc., 2006b). Attachment 28 of the Application for a Special Waste Landfill Permit – Shawnee Fossil Plant Special Waste Landfill Horizontal Expansion goes into detail of the regional geology of the site. In summary, the site is in a region known as the Jackson Purchase region. This area was theorized to have been considered a shallow sea in which the Warsaw Limestone was deposited. A long period of non-deposition and weathering followed leading to Karst formations in some locations (Tennessee Valley Authority (TVA), 2005b).

Site inspections of Ash Pond 2 were conducted and documented regularly from 1971 to 2017. These inspections were reviewed for observations of potential deficiencies within the surface impoundment or along the perimeter dikes that indicate characteristic features of karstic formations. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

4.2 ASSESSMENT

As shown on the KGS karst potential map included in Appendix B, Ash Pond 2 is in a non-karst area, with no karst related characteristics (sinkholes, landslides, springs, etc.) within approximately five miles of the site. A map titled Karst Occurrence in Kentucky, compiled by the University of Kentucky, labels McCracken County as an "area underlain by bedrock with limited or no potential for karst development" (Kentucky Geological Survey, 2001).

The digital elevation models (DEMs) show no indication of areas susceptible to mass movement within the vicinity of the site. The nearest area having moderate to steep slopes is approximately 3 miles southeast of the site.

Based on the information presented in the inspection reports of Ash Pond 2, there have been no documented characteristic features of karstic formation. Accordingly, the CCR Rule-related criteria listed above for geologic and geomorphologic features have been met.

5.0 HUMAN-MADE FEATURES OR EVENTS (§257.64(B)(3))

Per §257.64(b)(3), the unstable areas demonstration must consider on-site or local human-made features or events when determining whether the area is unstable.

Assessment of the human-made features or events was completed considering the following criteria related to the CCR Rule:

- Review inspection reports of the CCR unit for any documented indications of tension cracking, settlement, depressions, or deformation of the unit's structural components (embankments, spillways, outlets, liners, leachate collection systems, or final covers).
- Review of routine operations and inspections at the landfill to maintain precaution from human-induced events or forces that might impair the integrity of structural components responsible for preventing unpermitted release of CCR into the environment.
- Review instrumentation installed to monitor the CCR unit to ensure readings are maintained within documented tolerances.
- Review of maps and other resources to confirm that the CCR unit is not located:
  - On previously mined or quarried areas;
  - On areas that have undergone excessive drawdown of groundwater; or,
  - On an old landfill.

5.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the CCR Rule.

Site inspections of Ash Pond 2 were conducted and documented regularly from 1971 to 2017. The inspections were reviewed for any observations of potential indications of human-induced events or forces that could have impaired the integrity of structural components, which are responsible for preventing the unpermitted release of CCR to the environment. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

Instrumentation has been monitored and reviewed by Stantec since 2009 for Ash Pond 2. Piezometers and inclinometers were installed on the perimeter of Ash Pond 2 and were monitored annually between 2009 to 2011. In 2012, instrumentation on the site was automated for continuous monitoring from TVA. Threshold exceedance levels were analyzed and established to be monitored on a quarterly basis (Stantec Consulting Services Inc., 2012b). Information regarding the installation and details of each instrument and the readings obtained is included within the

Report of Geotechnical Exploration and Slope Stability (Stantec Consulting Services Inc., 2010a) satisfying the requirements of this demonstration.

Appendix C contains maps presenting the locations of water wells, nearby quarries, oil and gas wells and lines, and gas fields.

5.2 ASSESSMENT

There are no industrial wells within 4 miles of the site. It is located approximately 3 miles northeast of the Paducah Gaseous Diffusion Plant (PGDF). The facilities at PGDF, owned by the Department of Energy, have ceased production operations in 2013 and have been undergoing aggressive remediations and cleanups since that time. An active clay quarry is located 14 miles southeast of the site. Based on the KGS maps, the site is not located within gas fields. There are no oil or gas wells, lines, or other related infrastructure within a quarter mile of the site. There are no records of the site being located on previous landfills or previously mined or quarried areas. It is not expected that human events related to these industries or their operations pose a negative impact to the structural components of Ash Pond 2.

The surface impoundment is being operated in accordance with the approved quality control and operational procedures in the approved KPDES permit and is subject to periodic inspection by the Kentucky Division of Water (KDOW).

There have been past exceedances documented in 2015 and 2016 that were analyzed and concluded to have occurred due to the increased river levels. Based on the available readings from instrumentation installed to monitor Ash Pond 2, threshold elevation exceedances are being monitored and documented with remedial action plans in the event the target thresholds are exceeded (Stantec/AECOM, 2016). There have been no exceedances of threshold, action, or notification levels of the instrumentation since the last available inspection (Stantec Consulting Services Inc., 2017c). The inspection reports of Ash Pond 2 document no reports of impaired structural components. Operations and inspection manuals include satisfactory measures to maintain precaution from human-induced events or forces that might impair structural components. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

Based on this assessment of the human-made features or events, the CCR Rule-related criteria listed above for human-made features and events have been met.

6.0 CONCLUSIONS

The following factors were reviewed to determine whether the Ash Pond 2 at the SHF site is in an unstable area:

- On-site or local soil conditions that may result in significant differential settling;
- On-site or local geologic or geomorphic features; and
- On-site or local human-made features or events (both surface and subsurface).

Based on the assessment herein, Ash Pond 2 located at SHF meets the requirements of §257.64 of the EPA Final CCR Rule for unstable areas.

7.0 REFERENCES

FMSM. (2006, June). *Special Waste Landfill Permit Horizontal Expansion, TVA Shawnee Fossil Plant, Consolidated Waste Stack Disposal Area, Attachment 28 - Structural Integrity Analysis, McCracken County, Kentucky.* Prepared for Tennessee Valley Authority (TVA), June.

Geocomp. (2016). *Initial Seismic Safety Factor Assessment, TVA Shawnee Fossil Plant Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, West Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), October 14.

Kentucky Geological Survey. (2001). *Karst Occurence in Kentucky.* University of Kentucky, Randall L. Paylor and James C. Currens.

LawGibb Group. (2000). *Report of Drilling Services, TVA Shawnee Fossil Plant, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), July 10.

MACTEC Engineering and Consulting, Inc. (2005). *Report of Geotechnical Exploration, TVA Shawnee Fossil Plant, Proposed Dry Fly Ash Lateral Expansion Project, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), November 2.

MACTEC Engineering and Consulting, Inc. (2006a). *Report of Geotechnical Exploration, Shawnee Fossil Plant, Proposed Dry Fly Ash Landfill Expansion Project, Paducah, Kentucky.* Prepared for Tennessee Valley Authority, March 8.

MACTEC Engineering and Consulting, Inc. (2006b). *Report of Geotechnical Exploration, TVA Shawnee Fossil Plant, Proposed Dry Fly Ash Landfill Expansion Project, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), March 10.

Singleton Materials Engineering Laboratory. (1986). *Shawnee 160-MW AFBC Demonstration Project Waste Handling System, Soils Investigation Program.* Prepared for Tennessee Valley Authority (TVA), April 30.

Stantec Consulting Services Inc. (2010a). *Report of Geotechnical Exploration and Slope Stability Evaluation, TVA Shawnee Fossil Plant, Ash Pond 1 & 2 and Consolidated Waste Dry Stack, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), July 14.

Stantec Consulting Services Inc. (2010b). *Report of USWAG Ground Water Monitoring Network Field Assessments, TVA Shawnee Fossil Plant, McCracken County, Kentucky.* Prepared for Tennessee Valley Authority (TVA), October 6.

Stantec Consulting Services Inc. (2012a). *Construction Certification Report, TVA Shawnee Fossil Plant, Ash Pond 2 Southeast Dike Seepage Improvements Project, Work Plan 4.* Prepared for Tennessee Valley Authority (TVA), February 6.

Stantec Consulting Services Inc. (2012b). *Report of Threshold Level Analysis, Instrumentation Monitoring Program, Coal Combustion Byproduct Storage Facilities, Various Plants.* Prepared for Tennessee Valley Authority (TVA), November 20.

Stantec Consulting Services Inc. (2014). *2014 Intermediate (Annual) Inspection of CCP Facilities and Ponds, TVA Shawnee Fossil Plant, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), April 24.

Stantec Consulting Services Inc. (2015). *2015 Formal (5 Year) Inspection of CCR Facilities and Ponds, TVA Shawnee Fossil Plant, Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), July 27.

Stantec Consulting Services Inc. (2016a). *Closure and Post-Closure Plan, Ash Pond 2 and Consolidated Waste Dry Stack, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, Paducah, Kentucky.*

Stantec Consulting Services Inc. (2016b). *History of Construction, TVA Shawnee Fossil Plant, Ash Pond 2, Paducah, Kentucky.* Prepared for Tennessee Valley Authority, October.

Stantec Consulting Services Inc. (2016c). *Initial Hazard Potential Classification Assessment, TVA Shawnee Fossil Plant, Ash Pond 2 (Main Ash Pond/Stilling Pond), EPA Final Coal Combustion Residuals (CCR) Rule, West Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), October 5.

Stantec Consulting Services Inc. (2016d). *Initial Static Safety Factor Assessment, TVA Shawnee Fossil Plant, Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, McCracken County, Kentucky.* Prepared for Tennessee Valley Authority (TVA), October 6.

Stantec Consulting Services Inc. (2016e). *Initial Structural Stability Assessment, Shawnee Fossil Plant, Ash Pond 2.*

Stantec Consulting Services Inc. (2017a). *Emergency Action Plan (EAP), TVA Shawnee Fossil Plant, Ash Pond 2 (Main Ash Pond/Stilling Pond), EPA Final Coal Combustion Residuals (CCR) Rule, West Paducah, Kentucky.* Prepared for Tennessee Valley Authority (TVA), April 17.

Stantec Consulting Services Inc. (2017b). *FY 2017 Intermediate Inspection of CCR Facilities, Shawnee Fossil Plant, Paducah, McCracken County, Kentucky.* Prepared for Tennessee Valley Authority (TVA), January 17.

Stantec Consulting Services Inc. (2017c). *FY2017 Intermediate Inspection of CCR Facilities, Shawnee Fossil Plant.* Paducah, McCracken County, Kentucky.

Stantec/AECOM. (2016). *Annual Instrumentation and Monitoring Program Final Report, Fiscal Year 2016, TVA Coal Combustion Product (CCP) Storage Facilities, Various Plants Alabama, Kentucky, and Tennessee.* Prepared for Tennessee Valley Authority (TVA), October 31.

Tennessee Valley Authority (TVA). (1969). *Soil and Foundation Exploration, Shawnee Steam Plant, Ash Pond, August 25.*

Tennessee Valley Authority (TVA). (2005a). *Waste Disposal Permit & Ash Stacking Plan, Shawnee Fossil Plant, Volume 1 of 2, December 2.*

Tennessee Valley Authority (TVA). (2005b). *Waste Disposal Permit & Ash Stacking Plan, Shawnee Fossil Plant, Volume 2 of 2, December 2.*

Thomas, R. D. (1905). *Soil Survey of M'Cracken County, Kentucky.* Paducah.

TriAD Environmental Consultants. (2016). *Initial Annual (Intermediate Inspection, Shawnee Fossil Plant, CCR Units.* Prepared for Tennessee Valley Authority (TVA), January 14.

U.S. Geological Survey. (1967). Geologic Quadrangle Map, Joppa QuadrangleMcCracken County, Kentucky. *Kentucky Geological Survey, GQ-652*. (U. o. The Commonwealth of Kentucky, Ed.) McCracken County, Kentucky: Kentucky Geological Survey.

United States Department of Agriculture Soil Conservation Service. (1976). *Soil Survey of Ballard and McCracken Counties, Kentucky.* Paducah.

APPENDIX A
SOIL CONDITIONS

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product 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 participants

Custom Soil Resource Report for Ballard and McCracken Counties, Kentucky, and Massac County, Illinois

Shawnee Fossil Plant

May 10, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is 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.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. 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.

The National Cooperative Soil Survey is 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 (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile 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 or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a 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.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

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. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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 drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

88° 49' 11" W — 88° 45' 34" W
37° 10' 17" N — 37° 8' 41" N
338500 338900 339300 339700 340100 340500 340900 341300 341700 342100 342500 342900 343300 343700
4115300 4114900 4114500 4114100 4113700 4113300 4112900 4112500

Map Scale: 1:14,400 if printed on B landscape (17" x 11") sheet.

N

0 200 400 800 1200 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ballard and McCracken Counties, Kentucky
Survey Area Data: Version 10, Sep 19, 2016

Soil Survey Area: Massac County, Illinois
Survey Area Data: Version 12, Sep 16, 2016

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2011—Oct 21, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Ballard and McCracken Counties, Kentucky (KY602)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BnD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded	48.3	2.6%
CaA	Calloway silt loam, 0 to 2 percent slopes	97.0	5.3%
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	12.9	0.7%
CnA	Chavies fine sandy loam, 0 to 3 percent slopes, frequently flooded	28.8	1.6%
Du	Dumps, Coal, and Waste disposal areas	484.1	26.5%
Fa	Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded	17.8	1.0%
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	16.0	0.9%
GrC3	Grenada silt loam, 6 to 12 percent slopes, severely eroded	77.3	4.2%
HhA	Henshaw silt loam, 0 to 2 percent slopes, frequently flooded	16.3	0.9%
Hm	Huntington-Combs complex, 0 to 2 percent slopes, frequently flooded	49.6	2.7%
Hn	Huntington and Nolin silty clay loams, 0 to 2 percent slopes, frequently flooded	14.9	0.8%
LpD3	Loring-Purchase complex, 12 to 20 percent slopes, severely eroded	0.4	0.0%
M-W	Miscellaneous water	77.0	4.2%
Me	Melvin silty clay loam, 0 to 2 percent slopes, frequently flooded	27.6	1.5%
Mn	Melvin silty clay loam, ponded	42.3	2.3%
Ne	Newark-Lindside complex, 0 to 2 percent slopes, frequently flooded	75.7	4.1%
RtA	Routon silt loam, 0 to 2 percent slopes	91.5	5.0%
UoA	Uniontown silt loam, 0 to 2 percent slopes, frequently flooded	19.0	1.0%

Ballard and McCracken Counties, Kentucky (KY602)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
UrA	Urban land-Udorthents complex, 0 to 4 percent slopes	112.4	6.2%
W	Water	352.0	19.3%
WnA	Wheeling silt loam, 0 to 2 percent slopes, frequently flooded	116.8	6.4%
WnB	Wheeling silt loam, 2 to 6 percent slopes, frequently flooded	14.8	0.8%
Ye	Yeager fine sandy loam, 0 to 4 percent slopes, frequently flooded	23.6	1.3%
Subtotals for Soil Survey Area		**1,815.9**	**99.4%**
Totals for Area of Interest		**1,826.3**	**100.0%**

Massac County, Illinois (IL127)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
W	Water	10.4	0.6%
Subtotals for Soil Survey Area		**10.4**	**0.6%**
Totals for Area of Interest		**1,826.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

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 maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. 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 important soil properties and qualities.

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

Soils of one series can differ in texture of the surface layer, 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 maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

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 maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Ballard and McCracken Counties, Kentucky

BnD3—Brandon silt loam, 12 to 20 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qm5y
Elevation: 350 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Brandon, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brandon, Severely Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thin fine-silty noncalcareous loess over fluviomarine deposits

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 27 inches: silty clay loam
H3 - 27 to 80 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Feliciana, severely eroded

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Saffell, severely eroded

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Smithdale, severely eroded

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

CaA—Calloway silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1qm5h
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Calloway and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calloway

Setting

Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 22 inches: silt loam

H3 - 22 to 34 inches: silty clay loam
H4 - 34 to 69 inches: silt loam
H5 - 69 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 17 to 36 inches to fragipan
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 7 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Grenada

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Routon

Percent of map unit: 3 percent
Landform: Flats
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Falaya

Percent of map unit: 1 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 1 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

CaB2—Calloway silt loam, 2 to 4 percent slopes, eroded

Map Unit Setting

National map unit symbol: 1qm5j
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Calloway and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calloway

Setting

Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 18 inches: silt loam
H3 - 18 to 25 inches: silty clay loam
H4 - 25 to 50 inches: silt loam
H5 - 50 to 80 inches: silt loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: 24 to 38 inches to fragipan
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Grenada

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Purchase

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

CnA—Chavies fine sandy loam, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qm6z
Elevation: 310 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Chavies, frequently flooded, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chavies, Frequently Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Mixed coarse-loamy alluvium

Typical profile

H1 - 0 to 12 inches: fine sandy loam
H2 - 12 to 44 inches: fine sandy loam
H3 - 44 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Wheeling

Percent of map unit: 15 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Lakin

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Chavies, (hydric, flooding)

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Du—Dumps, Coal, and Waste disposal areas

Map Unit Setting

National map unit symbol: 1qm65
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Dumps, coal and waste disposal areas: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps, Coal And Waste Disposal Areas

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Water

Percent of map unit: 5 percent
Hydric soil rating: No

Fa—Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 1qm4q
Elevation: 320 to 450 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Falaya, occasionally flooded, and similar soils: 55 percent
Collins, occasionally flooded, and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Falaya, Occasionally Flooded

Setting

Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 52 inches: silt loam
H3 - 52 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Description of Collins, Occasionally Flooded

Setting

Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty alluvium

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 22 to 40 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Very high (about 12.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Vicksburg
Percent of map unit: 3 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Waverly, occasionally flooded
Percent of map unit: 3 percent
Landform: Flood plains, drainageways
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Iuka
Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Center
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Kurk
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

GrB3—Grenada silt loam, 4 to 6 percent slopes, severely eroded

Map Unit Setting
National map unit symbol: 1qgc0
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Grenada, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grenada, Severely Eroded

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 18 inches: silt loam
H3 - 18 to 22 inches: silt loam
H4 - 22 to 32 inches: silt loam
H5 - 32 to 80 inches: silt loam

Properties and qualities

Slope: 4 to 6 percent
Depth to restrictive feature: 18 to 23 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Purchase, severely eroded

Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Calloway

Percent of map unit: 4 percent
Landform: Ridges

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Falaya

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

GrC3—Grenada silt loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qls1
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Grenada, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grenada, Severely Eroded

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 18 inches: silt loam
H3 - 18 to 22 inches: silt loam
H4 - 22 to 32 inches: silt loam
H5 - 32 to 80 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 18 to 23 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Purchase, severely eroded

Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Calloway

Percent of map unit: 4 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Falaya

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

HhA—Henshaw silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qkxc
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Henshaw, frequently flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Henshaw, Frequently Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 15 inches: silt loam
H3 - 15 to 32 inches: silty clay loam
H4 - 32 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Henshaw, (hydric, flooding)
Percent of map unit: 10 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Uniontown
Percent of map unit: 3 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Newark, (hydric, flooding)
Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Wheeling
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hm—Huntington-Combs complex, 0 to 2 percent slopes, frequently flooded

Map Unit Setting
National map unit symbol: 1qgd4
Elevation: 310 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition
Huntington, frequently flooded, and similar soils: 60 percent
Combs, frequently flooded, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huntington, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 18 inches: silt loam
H2 - 18 to 65 inches: stratified silt loam
H3 - 65 to 80 inches: stratified fine sand to loam to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Combs, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed coarse-loamy alluvium

Typical profile

H1 - 0 to 14 inches: silt loam
H2 - 14 to 31 inches: loam
H3 - 31 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Nolin

Percent of map unit: 8 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Yeager

Percent of map unit: 3 percent
Landform: Natural levees
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Huntington, (hydric, flooding)

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Combs, (hydric, flooding)

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Hn—Huntington and Nolin silty clay loams, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qgd5
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Huntington, frequently flooded, and similar soils: 45 percent
Nolin, frequently flooded, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huntington, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 18 inches: silty clay loam
H2 - 18 to 65 inches: stratified silt loam
H3 - 65 to 80 inches: stratified fine sand to loam to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Nolin, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 9 inches: silty clay loam
H2 - 9 to 40 inches: silty clay loam
H3 - 40 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Huntington, (hydric, flooding)

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Nolin, (hydric, flooding)

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Lindside, (hydric, flooding)

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Combs

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Yeager

Percent of map unit: 1 percent
Landform: Natural levees
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

LpD3—Loring-Purchase complex, 12 to 20 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qm5p
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Loring, severely eroded, and similar soils: 45 percent
Purchase, severely eroded, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loring, Severely Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 20 inches: silt loam
H3 - 20 to 46 inches: silt loam
H4 - 46 to 80 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 18 to 24 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: D
Hydric soil rating: No

Description of Purchase, Severely Eroded

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile
H1 - 0 to 5 inches: silt loam
H2 - 5 to 10 inches: silt loam
H3 - 10 to 51 inches: silt loam
H4 - 51 to 80 inches: silt loam

Properties and qualities
Slope: 12 to 20 percent
Depth to restrictive feature: 5 to 18 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Feliciana, severely eroded
Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Brandon, severely eroded
Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

M-W—Miscellaneous water

Map Unit Setting

National map unit symbol: 1qm7p
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Water, miscellaneous: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Me—Melvin silty clay loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qm67
Elevation: 300 to 320 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Melvin, frequently flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melvin, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 42 inches: silty clay loam
H3 - 42 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Newark, (hydric, flooded)

Percent of map unit: 7 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Karnak, frequently flooded

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Mn—Melvin silty clay loam, ponded

Map Unit Setting

National map unit symbol: 1qm66
Elevation: 300 to 320 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Melvin, ponded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melvin, Ponded

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 42 inches: silty clay loam
H3 - 42 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 36 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Karnak, ponded

Percent of map unit: 7 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Newark, (hydric, flooded)

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Ne—Newark-Lindside complex, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qgd6
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Newark, (hydric, flooding), and similar soils: 50 percent
Lindside, (hydric, flooding), and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newark, (hydric, Flooding)

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 55 inches: silty clay loam
H3 - 55 to 80 inches: stratified fine sandy loam to loam to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Lindside, (hydric, Flooding)

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 53 inches: silty clay loam
H3 - 53 to 80 inches: stratified fine sandy loam to loam to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Hydric soil rating: Yes

Minor Components

Melvin, (hydric, flooding)

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Newark

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Lindside

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Karnak, (hydric, flooding)

Percent of map unit: 2 percent
Landform: Flood plains

Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Nolin

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

RtA—Routon silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1qgbt
Elevation: 320 to 420 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Routon and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Routon

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 52 inches: silt loam
H3 - 52 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Very high (about 12.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Kurk

Percent of map unit: 12 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Natalbany

Percent of map unit: 7 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Center

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

UoA—Uniontown silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qkxt
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Uniontown, frequently flooded, and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Uniontown, Frequently Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silty clay loam
H4 - 60 to 80 inches: stratified fine sandy loam to loam to silt loam to silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 12.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Uniontown, (hydric, flooded)

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Henshaw

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Wheeling

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: No

Henshaw, (hydric, flooded)
Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

UrA—Urban land-Udorthents complex, 0 to 4 percent slopes

Map Unit Setting
National map unit symbol: 1qmkz
Elevation: 320 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 65 percent
Udorthents and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Properties and qualities
Slope: 0 to 4 percent
Runoff class: Very high
Depth to water table: About 18 to 24 inches

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Udorthents

Setting
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Properties and qualities
Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches

Runoff class: Medium
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Grenada
Percent of map unit: 4 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Routon
Percent of map unit: 4 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Loring
Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Feliciana
Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Collins
Percent of map unit: 1 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Falaya
Percent of map unit: 1 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 1qm7q
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WnA—Wheeling silt loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qm74
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wheeling, frequently flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheeling, Frequently Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-loamy alluvium

Typical profile

H1 - 0 to 13 inches: silt loam
H2 - 13 to 28 inches: silty clay loam
H3 - 28 to 46 inches: clay loam
H4 - 46 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Uniontown

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Wheeling, (hydric, flooding)

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: Yes

Nolin

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Henshaw

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Chavies

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Hydric soil rating: No

WnB—Wheeling silt loam, 2 to 6 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1qm77
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wheeling, frequently flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheeling, Frequently Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Mixed fine-loamy alluvium

Typical profile

H1 - 0 to 13 inches: silt loam
H2 - 13 to 28 inches: silty clay loam
H3 - 28 to 46 inches: clay loam
H4 - 46 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Uniontown
Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Wheeling, (hydric, flooding)
Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: Yes

Nolin
Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Chavies
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Henshaw
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ye—Yeager fine sandy loam, 0 to 4 percent slopes, frequently flooded

Map Unit Setting
National map unit symbol: 1qgdr
Elevation: 300 to 330 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Yeager, frequently flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yeager, Frequently Flooded

Setting

Landform: Natural levees
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 12 inches: fine sandy loam
H2 - 12 to 80 inches: stratified sand to fine sand to loamy sand to loamy fine sand to fine sandy loam to loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Hydric soil rating: Yes

Minor Components

Yeager

Percent of map unit: 10 percent
Landform: Natural levees
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Combs

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Nolin

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Huntington

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Massac County, Illinois

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Landform: Perenial streams, oxbows, channels, rivers, drainageways, lakes

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8w

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

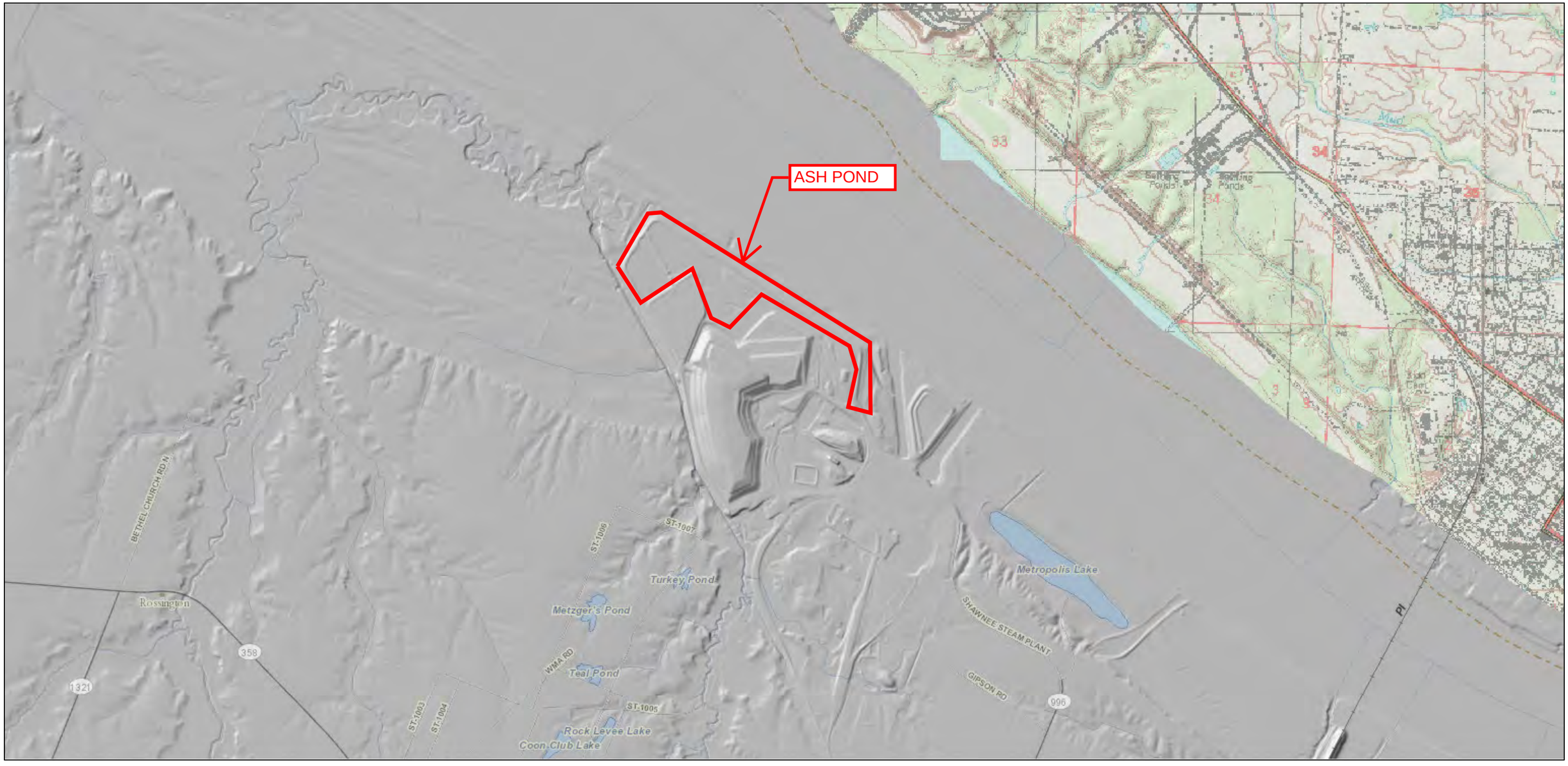
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX B
GEOLOGIC OR GEOMORPHOLOGIC CONDITIONS

Kentucky Geologic Map Information Service



May 10, 2017

LiDAR Hillshade DEM Map

1:24,000

0 0.275 0.55 1.1 mi

0 0.45 0.9 1.8 km

Kentucky Geological Survey
Kentucky Division of Geographic Information (DGI)

author: Kentucky Geological Survey

Kentucky Geologic Map Information Service

May 10, 2017

1:24,000

0 0.275 0.55 1.1 mi

0 0.45 0.9 1.8 km

Slope Raster Map

Kentucky Geological Survey
Kentucky Division of Geographic Information (DGI)

author: Kentucky Geological Survey

Legend (Base/ KY_Slope)

KY Slope: color (0)

High : 81.4303

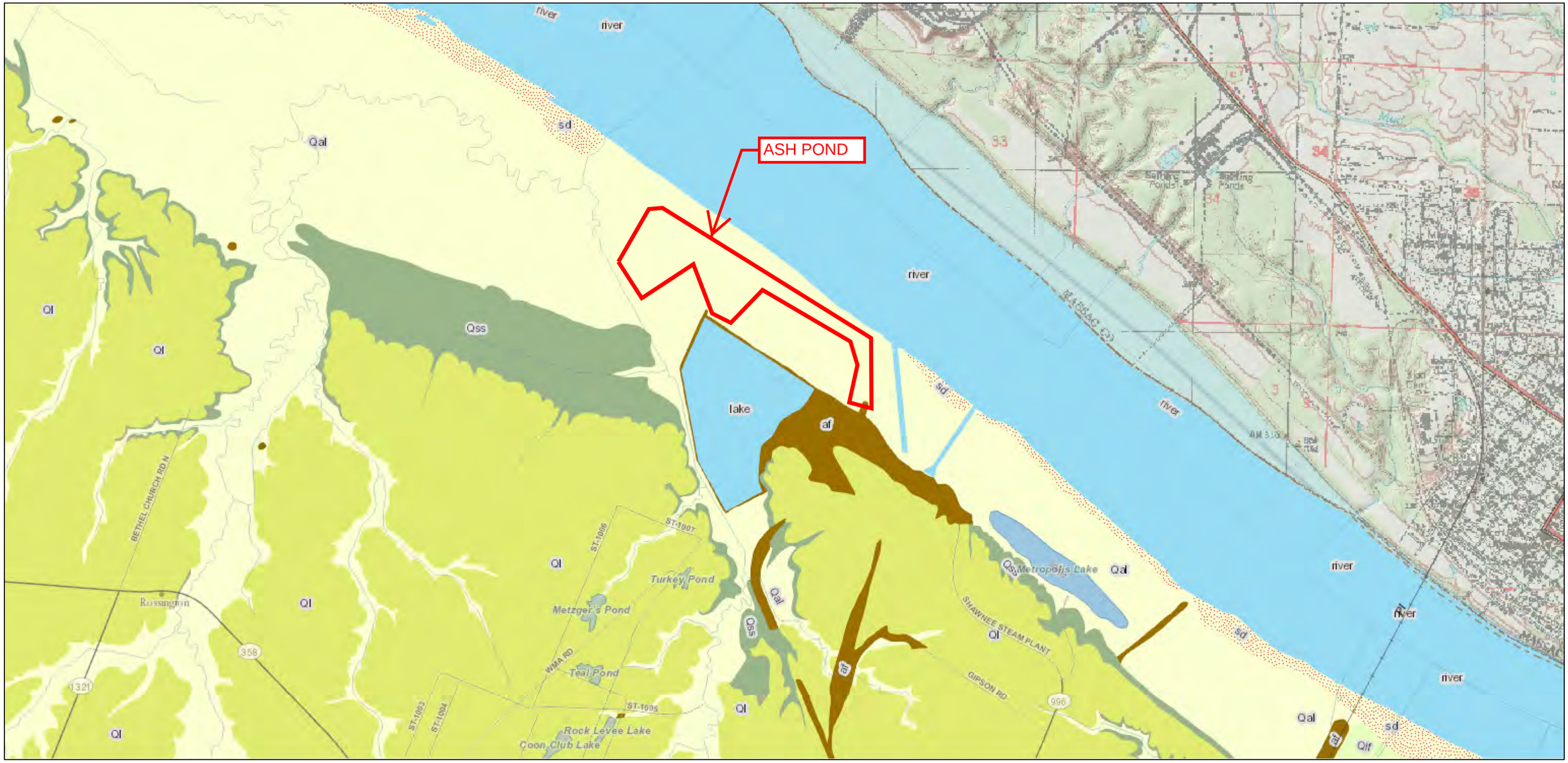
Low : 0

KY Slope: bw (1)

High : 81.4303

Low : 0

Kentucky Geologic Map Information Service



May 10, 2017

1:24,000

0 0.275 0.55 1.1 mi

0 0.45 0.9 1.8 km

Geology Map

Kentucky Geological Survey
Kentucky Division of Geographic Information (DGI)

author: Kentucky Geological Survey

Kentucky Geologic Map Information Service
Kentucky Geological Survey
Map Legend

Print This Page

NOTE: in order to print colors, make sure your browser is enabled to print background colors.
Internet Explorer Instructions: Go to Tools --> Internet Options --> Advanced --> Under the "Printing" header, click the "Print background colors and images" box.
Firefox Instructions: Go to File --> Page Setup --> Click the "Print Background (colors & images)" box.

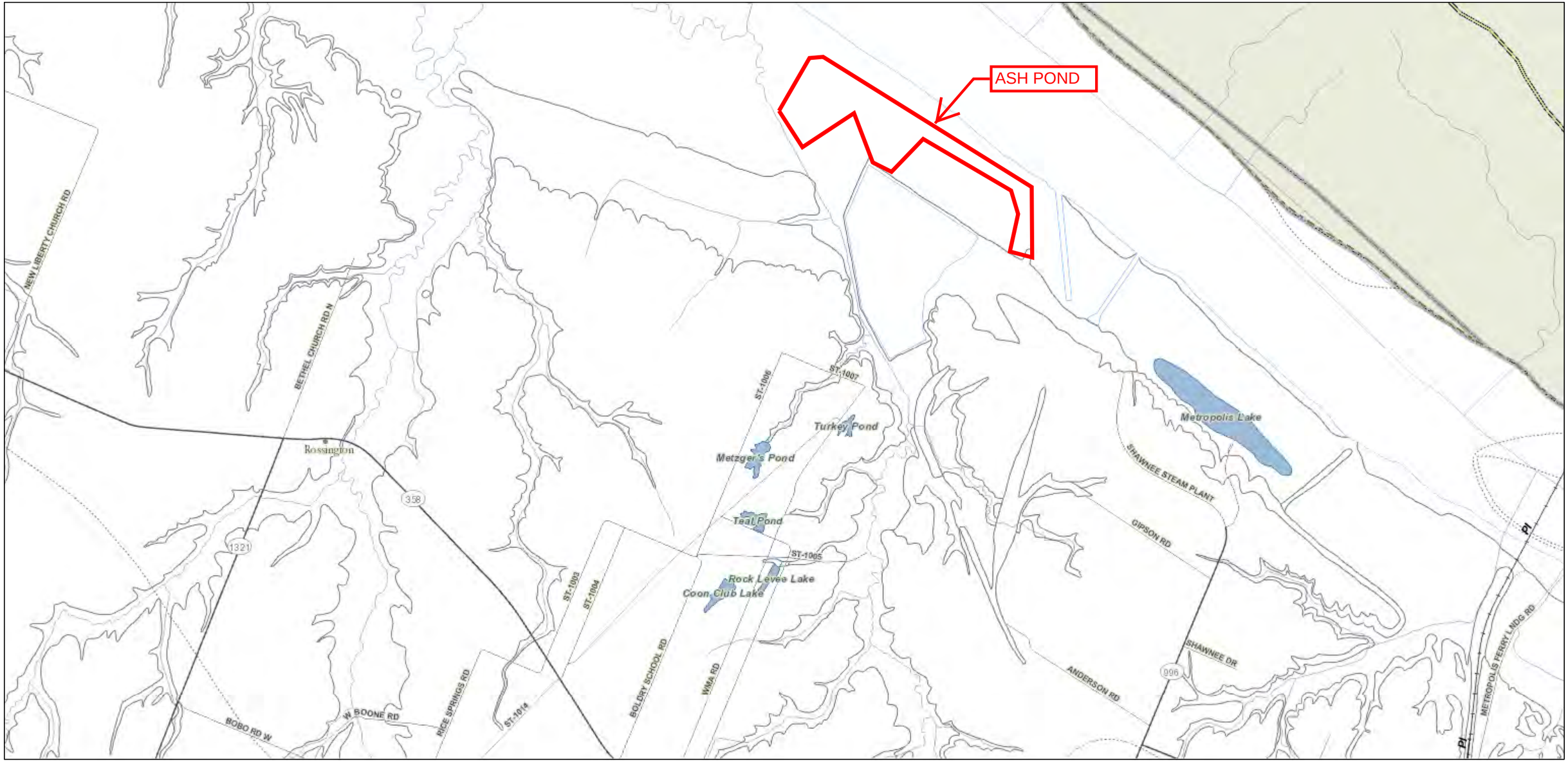
Geologic Units

map unit colors

1:24,000 scale data (detailed geology)
This legend includes all units from the 1:24,000 quadrangles in the current view. Some units on the legend may not appear on the map.

Qss	Silt and sand deposits (Quaternary - Quaternary)
Qal	Alluvium (Quaternary - Quaternary)
gr	gravel (Quaternary - Quaternary)
Qs	sand (Quaternary - Quaternary)
QTg	gravel (Quaternary - Quaternary)
Qs2	sand (Quaternary - Quaternary)
Qlf	Lacustrine and fluvial deposits (pre-Illinoian) (Quaternary - Quaternary)
Ql	Loess (Quaternary - Quaternary)
QTc	Continental deposits (Tertiary - Quaternary)
Tc	Claiborne Formation (Tertiary - Tertiary)
clc	clay bed of Claiborne Formation (Tertiary - Tertiary)
Tw	Wilcox Formation (Tertiary - Tertiary)
clw	clay bed of Wilcox Formation (Tertiary - Tertiary)
Tp	Porter Creek Clay (Tertiary - Tertiary)

Kentucky Geologic Map Information Service



April 27, 2017

1:24,000

0 0.275 0.55 1.1 mi

0 0.45 0.9 1.8 km

Karst Potential Map

Kentucky Geological Survey
Kentucky Division of Geographic Information (DGI)

Symbols

map symbols

Symbols are updated as layers are turned on/off and as they become visible by zooming in/out.

KGS Water Wells and Springs

Kentucky Springs

spring

KGS Landslide Locations

KGS landslide inventory data

KGS landslide inventory data

1:24,000 geologic map landslides

1:24,000 geologic map landslides

Landslide areas derived from LiDAR

Landslide areas derived from LiDAR

Landslide areas derived from aerial photography

Landslide areas derived from aerial photography

Areas susceptible to debris flows

Areas susceptible to debris flows

KGS Sinkholes

Kentucky Sinkhole Outlines

Sinkhole

KY Slope

KY Slope: color

High : 81.4303

Low : 0

KGS Geology

24K Geologic Faults

fault - concealed

fault

fault - inferred

fault - scarp

fault - secondary

24K Geologic Contacts

geologic contact

contact - concealed

contact - secondary

contact - arbitrary

stratigraphic datum shift

unconformity

unconformity - concealed

formal bed

formal bed - concealed

strip mine

water (river, lake, etc...)

state line

non-coal beds

KENTUCKY GEOLOGICAL SURVEY
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

MAP AND CHART 33
Series XII, 2001

KARST OCCURRENCE IN KENTUCKY

Randall L. Paylor and
James C. Currens

This map was compiled from a digital version of the 1:500,000-scale geologic map of Kentucky (Noger, M.C., comp., 1988, Geologic map of Kentucky: U.S. Geological Survey). The areas of potential karst development were delineated using stratigraphic units mapped on the geologic map. The classification of the potential for karst development was based on the field experience of the authors and other data. A number of isolated carbonate units that would not have otherwise been differentiated on the geologic map were newly digitized for this map.

This karst map should not be used for evaluating karst geologic hazards or hydrogeology at scales larger than 1:500,000. The base geologic map was digitized at 1:500,000 scale and is limited in precision to that scale. Because of the small scale of the original geologic map, lithostratigraphic units were consolidated into thicker chronostratigraphic units to create an area large enough to delineate on the geologic map. In some cases, the consolidation resulted in carbonates (limestone or dolomite) and noncarbonates (sandstone or shale, for example) being grouped; these rocks are not redivided on this map. Although the potential for karst development can be predicted from lithology, other factors such as relief and length of time the rock is exposed are also important and were not considered in the making of this map. Finally, areas where the near-surface bedrock is insoluble and closely underlain by soluble rock are common, particularly in the Eastern Pennyroyal. Conduits that pirate drainage commonly extend through ridges capped with insoluble rocks. Therefore, some areas mapped as having limited potential that are adjacent to areas of higher potential are actually karst, but cannot be differentiated on this map.

Karst is a terrane that is generally underlain by limestone or dolomite, where the topography is formed chiefly by the dissolving of rock. Karst landscapes are commonly characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, large springs, and caves.

Karst regions are susceptible to unique problems such as sinkhole collapse, sinkhole flooding, and rapid groundwater pollution. Springs in karst areas are an important, productive source of groundwater. Rare biologic communities and endangered species can be found in the fragile underground environments developed in karst landscapes.

For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call:

Publication Sales
859.257.3896

View the KGS World Wide Web site at
www.uky.edu/kgs

N

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

EXPLANATION

- Areas underlain by bedrock with high potential for karst development
- Areas underlain by bedrock with moderate potential for karst development
- Areas underlain by bedrock with limited or no potential for karst development

SHAWNEE FOSSIL PLANT

Western Pennyroyal Region

Outer Bluegrass Region

Inner Bluegrass Region

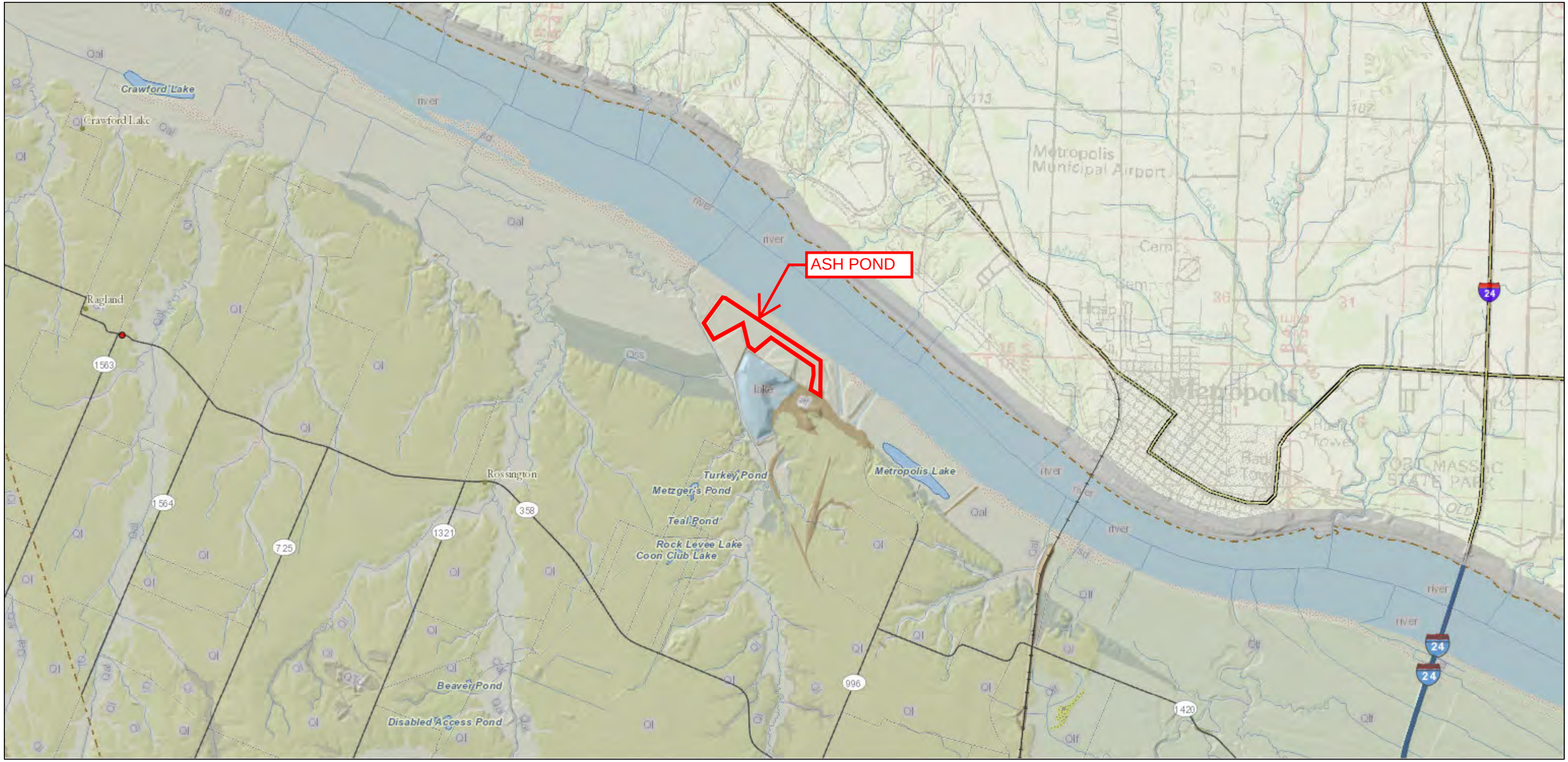
Eastern Pennyroyal Region

Pine Mountain Region

Cartography by Terry Hounshell

APPENDIX C
HUMAN-MADE FEATURES OR EVENTS

Kentucky Geologic Map Information Service



May 10, 2017

1:50,000

0 0.5 1 2 mi

0 0.75 1.5 3 km

Human-Made Features Map

Kentucky Geological Survey
Kentucky Division of Geographic Information (DGI)

Symbols

map symbols

Symbols are updated as layers are turned on/off and as they become visible by zooming in/out.

KGS Oil and Gas Gathering Lines

Oil and Gas Gathering Lines

- Other
- Oil and Gas Flow
- Oil and Gas Gathering
- Gas Flow
- Gas Gathering
- Oil Flow
- Oil Gathering
- Water Injection

KGS Oil and Gas Fields

KY Oil and Gas Fields

- Oil
- Gas
- Waterflood
- Big Sandy
- Consolidated

KGS Oil and Gas Wells

KY Oil and Gas Wells

- Other Well
- Service or Secondary Recovery Well
- Coal Bed Methane Gas Well
- Dry and Abandoned Well
- Gas Well
- Location
- Oil and Gas Well
- Oil Well

Record Number

- Record Number

KGS Water Wells and Springs

Kentucky Water Wells

- Other
- Domestic
- Industrial
- Agriculture
- Monitoring
- Public
- Mining
- Geothermal

KGS Non Coal Quarries

KY non coal quarries and pits

- Unknown
- Abandoned
- Active

non-coal beds